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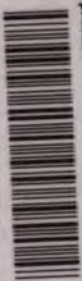
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A PRACTICAL TREATISE
ON THE
URINARY ORGANS.

A
PRACTICAL TREATISE
ON THE
DISEASES, INJURIES, AND MALFORMATIONS
OF THE
URINARY BLADDER,
THE
PROSTATE GLAND, AND THE URETHRA.

BY
S. D. GROSS, M. D.,
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LOUISVILLE MARINE HOSPITAL; MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY;
AUTHOR OF "ELEMENTS OF PATHOLOGICAL ANATOMY;"
"A TREATISE ON FOREIGN BODIES IN THE AIR-PASSAGES," ETC. ETC. ETC.

SECOND EDITION,
REVISED, AND MUCH ENLARGED.
WITH
ONE HUNDRED AND EIGHTY-FOUR ILLUSTRATIONS.



PHILADELPHIA:
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1855.
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TO

R. LA ROCHE, M. D.,

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, ETC. ETC. ETC..

AN ELEGANT SCHOLAR,

A LEARNED WRITER,

AND AN ACCOMPLISHED PHYSICIAN,

This Edition of this Work

IS RESPECTFULLY AND AFFECTIONATELY INSCRIBED,

BY HIS PERSONAL FRIEND,

THE AUTHOR.

PREFACE TO THE SECOND EDITION.

THE present edition of this work has been augmented by upwards of two hundred pages, and by seventy-eight illustrations. The additions are dispersed through the work in the form of new paragraphs, sections, and chapters, which impart to it somewhat of the aspect of a new treatise. My only regret, in making these additions, is that the size of the volume has, in consequence, been increased beyond the usual limits of an octavo. A large book is undoubtedly a great evil, but I trust that this will not be viewed in that light. My object has been to afford at least satisfactory, if not full, information upon every subject treated of in its pages; a task which it would have been impossible to accomplish in a smaller compass.

In the Appendix will be found a chapter on the prevalence of calculous disorders in the United States and Canada, constituting, it is believed, the first attempt that has ever been made to collect and systematize our information upon that subject. The facts submitted there are of intrinsic value, and it is to be hoped that they will have the effect of awakening further and more extended inquiry into the etiology of a class of affections of such frequency and importance. There is no reason, it seems to me, why the causes of urinary calculi should not be eventually detected, and their formation counteracted, if not prevented, by the timely interposition of remedies, without the necessity of an ultimate resort to the knife. The circumstances which have hitherto been assigned for their occurrence are, for the most part, wholly destitute of truth, while not a few of them are positively absurd. The information comprised

in this portion of the work has been collected with much labor from different sources, which have been duly acknowledged in their appropriate places.

The whole work has been thoroughly revised, and thus rendered, I trust, still more worthy of the patronage and confidence of the profession. The sheets, as they passed through the press, were carefully inspected, first by myself, and subsequently by my distinguished friend, Professor Francis Gurney Smith, of Philadelphia, whose aid and kindness, in this respect, it affords me great pleasure again to acknowledge.

Finally, I cannot but indulge the hope that the work, in its present improved form, will have the effect of arousing the attention of the profession to a more full and just appreciation of the important and interesting affections of which it treats, and of elevating them, in their estimation, to the same rank as the maladies of the eye, ear, and other organs, concerning which so much has been published in the various languages of Europe. When it is recollected that these affections are of daily occurrence in every community, that they entail a vast amount of suffering, and that they are a frequent source of mortality, it is surprising, nay, positively shocking, to find how much they are neglected by systematic writers and public teachers.

S. D. GROSS.

UNIVERSITY OF LOUISVILLE,
May 1, 1855.

PREFACE TO THE FIRST EDITION.

THE object of this work is to present, in a systematic and connected form, a full and comprehensive account of the diseases and injuries of the urinary bladder, the prostate gland, and the urethra. No apology can be necessary for such an undertaking. For many years I have myself felt the want of just such a book, or, at any rate, of one very much like it. No practitioner, who has been at all extensively engaged in the active duties of his profession, can have failed to perceived, as well as to lament, the defects which exist in the literature of this particular department of the healing art. While every other organ of the body has had its expounder and monographist, it is a singular fact that no systematic treatise has yet appeared, in the English language, on the maladies of the structures in question, especially those of the bladder, which are so common and so important, both in their pathological and practical relations.

There has not yet been an attempt made on the part of any American writer to supply this deficiency ; and it is no disparagement to the foreign works which have been republished in this country to assert, that, valuable as in many respects they are, they are far in arrear of the existing state of the science to which they relate. The treatise of Sir Benjamin Collins Brodie, the very best in the English language, is a mere outline of the subject ; and the same is true of the excellent volume of Mr. Coulson. The student seeks in vain in these productions for a full and comprehensive exposition of the nature, causes, symptoms, and treatment of the various lesions of the urinary apparatus, and of the operations which are required

for their relief. He rises from their perusal unsatisfied and discontented, regretting that writers so able, intelligent, and experienced, should have limited themselves to so superficial a discussion of such an important and interesting class of affections. The monograph of the late Dr. Parrish, of Philadelphia, is a mere sketch of the more common diseases of the urinary bladder, and was never designed by its lamented author as a systematic treatise. Regarded as a record of the experience of an excellent observer and a skilful surgeon, it is exceedingly valuable, and cannot be too strongly recommended to the practitioner. It would, in fact, be difficult to find within the same compass, in the English language, a more truly useful contribution to the science of our profession. From the circumstance, however, that it has never been published in a separate form, it is doubtful whether it has received from the physicians of this country the consideration to which its intrinsic merits entitle it. Dr. Parrish enjoyed for many years a most extensive practice, and there never has been a member of the American medical profession whose statements are more worthy of credit, or whose writings are characterized by a higher tone of moral feeling, or a greater share of genuine modesty. His remarks on retention of urine, and the use of the catheter, should be read and studied by every physician and surgeon.

It will thus be perceived that I have written this work, not merely for the sake of composing a book, but for the purpose of filling, if possible, a void in medical literature. I have endeavored to perform for the bladder, the prostate gland, and the urethra, what has been so well done by Lawrence and Mackenzie for the eye, Hope for the heart, Budd for the liver, and Curling for the testis. How far I have succeeded in my design it is not for me to judge. Suffice it to say, that I have aimed honestly and faithfully to discharge the duties which I had thus voluntarily assumed, and that my sole object has been to furnish a monograph on the diseases and injuries of the urinary organs, that should be worthy of the favorable consideration of my professional brethren, and also, I trust, in some degree, of the present state of medical science in this country.

The materials of which the work consists have been gradually accumulating upon my hands for a long time; but it has been only within the last three years that the labor of arranging them, and of putting them in their present form, seriously occupied my attention. The task, although not a light, has been an agreeable one. As the subject expanded under my eye, my feelings became more and more interested, and I almost regretted, when the last line was written, that my labor was ended. In looking over the printed sheets, as they have been sent to me by my publishers, I have found, here and there, an expression or a sentence that might have been improved, if I could have personally superintended the press; but the errors are, I believe, few and unimportant, and such as an indulgent reader, intent upon the acquisition of knowledge, rather than the discovery of faults, will readily excuse. My friend, Dr. Francis Gurney Smith, the talented editor of the *Philadelphia Medical Examiner*, is entitled to my warmest thanks for the able manner in which he has corrected the proofs. The labor of superintending the press of a large scientific work may be imagined by the reader, but can only be appreciated by him who has actually experienced it.

The work is illustrated by upwards of one hundred engravings on wood, of which nearly one-half are from drawings prepared expressly for it, under my immediate supervision, by Mr. Henry A. Daniels, of New York, a young artist of great promise. Their fidelity may, therefore, be fully relied upon. The engravings were executed by Mr. W. B. Gihon, of Philadelphia, whose skill in this particular department of art is well known.

It was originally my intention to issue a separate volume of plates, of the full size of nature, as a companion to the text; but it was soon discovered that such a proceeding would so enhance the expense of the work as to place it beyond the reach of many of those for whose benefit it is more particularly designed. The plan was, therefore, abandoned, though it is my intention to carry it out at some future period. It is proper to add, that a number of the drawings are from preparations in the pathological museum of the

New York Hospital, to which, through the kindness of Dr. Post and Dr. Watson, free access was afforded me by Dr. Bowen, the polite and accomplished curator of that beautiful and valuable collection. My acknowledgments are also due, for similar favors, to Dr. Sabine, of New York, to Professors Parker and Watta, of the College of Physicians and Surgeons of that city, and to Professor Cox, of the New York Medical College.

LOUISVILLE, *June*, 1851.

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INTRODUCTION.

INTRODUCTION.

CHAPTER I.

ANATOMY OF THE PERINEUM.

THE term perineum was formerly restricted to the triangular space comprised between the arch of the pubes and the upper margin of the anus, or an imaginary line extended from one tuberosity of the ischium to the other. At the present day, however, it is used in a wider sense, and is made to include also the region which intervenes between the point here specified and the extremity of the coccyx. Considered in this manner, the perineum is of a lozenge shape, the superior angle of which corresponds with the arch of the pubes; the inferior, with the tip of the coccyx; and the two lateral, with the ischiatic tuberosities. The most important objects embraced within these limits are the urethra and the anus, on which account the space is usually subdivided into two regions, having the form of two triangles, the bases of which are continuous with each other. To the upper part, which constitutes the perineum, properly so called, the term urethro-perineal is applied by modern anatomists, while the lower is denominated the ano-perineal.

The *boundaries* of the upper triangle are, superiorly, the pubic arch; inferiorly, an imaginary line extended from one ischiatic tuberosity to the other; and, laterally, the branches of the ischiatic and pubic bones. The sides of the triangle, which are nearly equal, rarely exceed three inches. The base is just above the verge of the anus, and consequently some distance below the level of the transverse perineal muscles. In the centre of the space is a slight elevation, known as the *raphé*, which divides it into two smaller triangles, of which the left is the one always selected for the lateral

operation of lithotomy, because it affords the surgeon an opportunity of using his right hand. To obtain a connected view of the perineum, it is necessary that the various structures of which it is composed should be examined in detail. For this purpose a moderately lean subject should be selected; he should be placed upon an ordinary dissecting-table, with the breech close to its edge, and the hands and feet should be tied as in lithotomy. A silver catheter should be at hand, to distend the urethra; and, to examine the deep structures of the perineum, the pubic bone of one side should be sawn through about an inch from the symphysis. This will afford an opportunity of dissecting Guthrie's and Wilson's muscles, Cowper's glands, the deep layer of the triangular ligament, and the membranous portion of the urethra.

The *skin* of the perineum is thin, delicate, and easily movable upon the subjacent structures, which renders it necessary to steady it with the finger before incising it in the operation of lithotomy. It is of a lighter color than that of the scrotum, and is always covered, after the age of puberty, with more or less hair. Numerous sebaceous follicles are contained in it, and towards the anus it usually presents a few small wrinkles, especially in old subjects. The most interesting object connected with it is a slight, narrow ridge, extended perpendicularly from the under surface of the penis, over the scrotum, as far back as the anus, where it terminates. This ridge is named the *raphé*. It forms the middle line of the perineum, and indicates the place of union of its two sides. Surgically considered, the *raphé* is of importance as a landmark to our incisions in the lateral operation of lithotomy, the introduction of the catheter, the opening of abscesses, and the division of impassable strictures.

Immediately beneath the skin, and consequently intimately connected with it, is a layer of *cellulo-adipose tissue*, the thickness of which is very variable in different subjects. In children and corpulent persons it frequently exceeds an inch. It is continuous above with the subcutaneous lamina of the scrotum, and laterally with that of the thighs, having no intimate connection anywhere with the pelvic bones. At the lower part of the perineum, in front of the anus, it sensibly diminishes in thickness, and can hardly be said, in most cases, to exist between the skin and the sphincter muscle of that opening. A number of small vessels, branches of the internal pudic, ramify through this substance; but they rarely bleed so much, when divided, as to require any particular attention.

The removal of the cellulo-adipose layer above described brings into view the *superficial fascia*, properly so called. This is a thin, delicate, fibrous lamella, of a triangular shape, which is spread over the muscles of the perineum, and is firmly attached on each side to the outer border of the branches of the pubic and ischiatic bones. In front, it is prolonged upwards into the scrotum, where it appears to become continuous with the dartos; behind, it winds round the posterior margin of the transverse muscle, and is finally inserted into the anterior layer of the triangular ligament of the urethra. This membrane consists of a single lamella, the fibres of which are for the most part disposed transversely; it is thin, transparent, and pierced at various points by the branches of the pudic vessels.

From the manner in which the superficial fascia is arranged, it is evident that urine, poured out in consequence of a rupture of the urethra, can travel only in one direction, namely, forwards towards the scrotum, and upwards towards the groins. Its passage along the inside of the thighs and backwards round the anus is prevented by the attachment of the membrane to the pelvic bones and the triangular ligament. In some instances, however, the fluid breaks through this barrier, and extends down along the inside of the lower extremities. Morton refers to a case in which it reached nearly as far down as the knee.

Such is a brief account of this fascia, as given by modern anatomists. To this description important additions have been recently made by Dr. Buck, one of the surgeons of the New York Hospital.¹ He has demonstrated by careful dissections, one of which I had the satisfaction to witness, that the perineal fascia forms distinct sheaths for the perineal muscles, the spongy structure of the urethra, and the cavernous bodies of the penis. The portion which invests the muscles arises, as already stated, from the branches of the ischiatic and pubic bones, as far forward as the inferior edge of the pubic symphysis, where it is remarkably strong, and constitutes what is called the suspensory ligament. Posteriorly, it is continued over the transverse muscles, and prolonged upwards, on each side, into the ischio-rectal fossa. If a careful dissection be made of the penis, the skin and cellulo-fatty matter having been previously removed, it will be found that the fascia completely incloses the cavernous bodies as far as the head of the organ, which, with a little caution,

¹ Transactions of the American Med. Assoc., vol. i. p. 367.

can be easily enucleated from the extremity of the two cylinders just mentioned, without disturbing its connection with the spongy structure of the urethra, which is itself invested by two layers of the fascia, one of them passing above, the other below it. The sheath is remarkably thick at the suspensory ligament, on the dorsal surface of the cavernous bodies, and at the crown of the penis, where its adhesions are also more distinctly marked. The cavity formed by the cavernous portion of the sheath is limited, posteriorly, by the triangular ligament.

From the dissections of Dr. Buck, it appears sufficiently evident that the perineal fascia answers the same purpose to the cavernous bodies of the penis, the spongy structure of the urethra, and perineal muscles, that the fascia lata does to the muscles of the thigh. It forms a complete sheath to these parts, which serves to bind them down in their respective places, at the same time that it separates them from each other, and thus limits their diseases. The part which the membrane plays in urinous infiltration has been already adverted to, and must strike every one at first sight.

The fourth layer of the perineum is formed by five *muscles*, Fig. 1, of which four occur in pairs, and are consequently perfectly

Fig. 1.



The muscles and boundaries of the perineum, the skin, cellular tissue, and superficial fascia having been removed. 1. The accelerator muscle—the figure rests on the spongy body. 2. The cavernous body on one side. 3. The erector muscle of the penis on one side. 4. The transverse muscle of the perineum. 4. The triangular space through which the deep perineal fascia is seen. 6. The sphincter muscle of the anus, of which the anterior extremity is cut off. 7. The elevator muscle of the anus of the left side. 8. The tuberosity of the ischium, between which and the anus is the ischio-rectal fossa. The same fossa is seen on the opposite side. 9. The spine of the ischium. 10. The left coccygeal muscle.

symmetrical in their shape, size, and situation. They are the transverse, the erector, and the accelerator, the latter being single. The

anal sphincter projects slightly into this region, and unites in front with the accelerator and the two transverse muscles, by a common point, called the *central tendon* of the perineum. This tendon has a whitish appearance, and is continuous with the cellulo-fibrous raphé of the accelerator muscle. It is situated between the bulb of the urethra and the anus, under cover of the superficial fascia and the common integuments. Posteriorly, it is in contact with the triangular ligament.

The *transverse muscle* is situated in front of the anus, at the boundary between this opening and the perineum, properly so called. It is a thin, flat, irregular bundle, somewhat triangular in its shape, and arises from the inner surface of the tuberosity of the ischium, just above the erector muscle. From this point it is directed inwards and a little forwards, to be inserted into the central tendon of the perineum, where it is sometimes continuous with its fellow of the opposite side. It is covered by the superficial fascia, and rests upon the triangular ligament of the urethra. Its office is to support the perineum, and to assist in defecation. The transverse muscle is sometimes absent; and, on the other hand, it is occasionally accompanied by a very small, delicate accessory muscle, running along its superior surface. It is always cut in the operation of lithotomy.

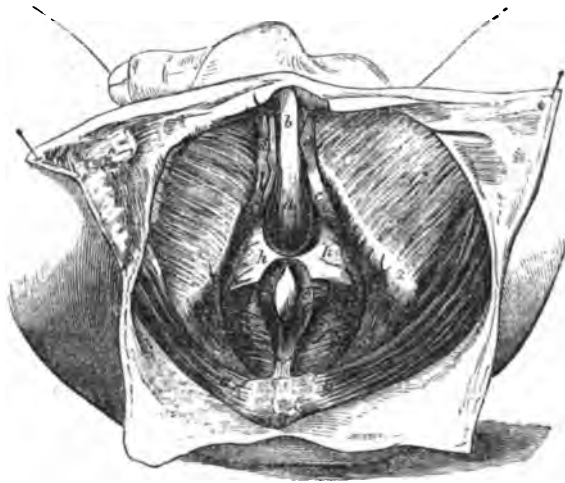
The *erector* is a flat, narrow muscle, about three inches in length, stretched along the lateral boundary of the perineum. It arises from the inner surface of the tuberosity of the ischium, immediately below the transverse muscle, passes forwards and upwards, and gradually degenerates into a strong, glistening aponeurosis, which is inserted into the sides of the cavernous body of the penis. The erector lies upon the branch of the ischium and the root of the virile member, under immediate cover of the superficial fascia. It is in relation on the inside with the accelerator muscle, from which, however, it is separated by a small quantity of cellular tissue and the superficial perineal artery. No part of this muscle is endangered in the operation for stone.

The *accelerator* muscle, called more appropriately the bulbo-cavernous muscle, is placed along the middle line of the perineum, which it thus separates into two equal portions. It is of a cylindrical figure, and surrounds the bulb and posterior part of the body of the urethra like a sheath, which, however, is incomplete at each extremity. A white cellulo-fibrous raphé extends along the under surface of the muscle through its whole length, and serves as a point

of origin to its fleshy fibres. From thence the fibres incline obliquely outwards and forwards to be inserted, the inferior into the triangular ligament of the urethra, the middle into each other, and the superior into the sides of the cavernous bodies of the penis. The lower part of the muscle is connected with the white tendinous line of the perineum, and through it, with the transverse and sphincter muscles. From the manner in which the middle fibres of the accelerator encircle the urethra, it is capable, under certain circumstances, of impeding, by its spasmodic action, the passage of the catheter along the posterior part of that tube. A few of the inferior fibres of this muscle are frequently divided in the operation of lithotomy.

The anterior part of the outlet of the pelvis is closed up by two *ligaments*, which are joined together in such a manner as to form a continuous lamella from the symphysis of the pubes to the rectum. They lie under cover of the muscles above described, and cannot be examined until these structures are removed. When this has been

Fig. 2.



The root of the penis and the bulb of the urethra, with the triangular ligament: the muscles of the perineum have been removed. 1. The coccyx. 2, 2. The tuberosities of the ischiatic bones. 3, 3. The fascia lata of the thighs. 4, 4. The great sacro-sciatic ligament. *a*. The bulb of the urethra. *b*. The spongy body. *c*, *c*. The limbs of the penis. *d*, *d*. The cavernous bodies. *e*, *e*. The external sphincter muscle of the anus. *f*, *f*. The elevators of the anus, covered by a prolongation of the triangular ligament. *g*, *g*. The great gluteal muscles. *h*, *h*. The triangular ligaments of the urethra. The artery of the bulb is seen on the left side as it runs between the leg of the penis and the bulb of the urethra.

done, it will be found that they differ from each other, not only in their situation, but likewise in their texture and arrangement.

There is hardly any part of the anatomy of the perineum which deserves to be more carefully investigated than this in relation both to the operation of lithotomy, the introduction of the catheter, and the various injuries and diseases to which this interesting and important region is subject. The ligaments here referred to are named respectively, from their situation and shape, the sub-pubic and the triangular.

The *sub-pubic*, pubic, or inter-pubic ligament, as it has been variously designated, occupies the upper part of the pubic arch, and is about half an inch in depth. It extends from the top of the arch to the superior margin of the triangular ligament, by the layers of which it is slightly overlapped, and is attached on each side to the inner border of the branch of the pubic bone. Its base, which is free, and a little concave, is directed downwards and backwards to the perineal space. In its structure, the sub-pubic ligament is very dense, firm, and resisting, being composed of close, transverse fibres, of a pale yellowish color.

The *triangular ligament* has been a source of much confusion, in consequence of the numerous names under which it has been described by anatomists. Thus, it has been called the triangular ligament of the urethra, the deep perineal fascia, the ligament of Cowper, the middle perineal fascia, and the recto-urethral aponeurosis. The term ischio-pubic would be more appropriate than any of these, inasmuch as it at once indicates both the situation and principal attachments of this lamella; but as I am not disposed to be an innovator, even in so trifling a matter as the naming of a ligament, I shall retain the appellation by which it is generally known in the books.

The triangular ligament is a strong membranous lamella, which closes up the greater portion of the space beneath the symphysis of the pubes. As the name by which it is here designated implies, it is of a triangular shape, being narrower above than below. It is attached on each side to the inner border of the pubic and ischial bones, and extends from the sub-pubic ligament, which it slightly overlaps, to the rectum, where it becomes continuous with the anal fascia. Its structure at this point is very delicate, and devoid of the ligamentous character which it presents higher up. It is pierced towards its superior margin by the dorsal veins of the penis, and somewhat lower down by the opening which serves to transmit the membranous portion of the urethra. This opening is situated about one inch below the pubic symphysis, directly opposite the raphé of

the perineum, and consequently equidistant from the inner borders of the branches of the pubic bones. It is of a circular shape, and varies in diameter from three to four lines. The opening is not

Fig. 3.



The triangular ligament of the urethra, the glands of Cowper, and the arteries of the bulb. The rectum has been removed, and the ligament, therefore, presents the appearance of terminating inferiorly by a free border, which, in the natural condition of the parts, is not the case. The figures 1, 1, mark Cowper's glands. 2. The posterior lamella of the triangular ligament, the anterior one having been cut away. 3, 3. The tuberosities of the ischiatic bones. 4. The pubic symphysis. A little below this figure is a strong semicircular band of fibres, which is the sub-pubic ligament. 5, 5. The dorsal arteries of the penis, the terminal branches of the internal pudic. 6, 6. The arteries of the bulb. 7. The opening in the triangular ligament through which the membranous portion of the urethra passes.

very well defined in the natural state in consequence of its edges being prolonged for some distance upon the urethra; but if the penis be cut off immediately in front of the ligament, it will be rendered very conspicuous.

The triangular ligament is composed of two laminæ, separated by a slight interval, in which are contained the glands of Cowper, the arteries of the bulb, a plexus of large veins, and the compressor muscles of the urethra, together with the base of the sub-pubic ligament. The anterior layer, which is much the stronger of the two, is prolonged forwards round the urethra, and is ultimately connected behind the transverse muscle with the superficial fascia. The posterior layer sends a similar process backwards towards the fibrous investment of the prostate gland, and is in close relation with the elevator muscle of the anus. The fibres of which this ligament is composed are arranged chiefly in a transverse direction, and are much more distinctly marked in front than behind, where they gradually degenerate into cellular tissue.

Included between the layers of the deep fascia are, on each side of the median line, two small muscles, which have recently attracted much attention, not so much on account of any interest which they possess in relation to lithotomy and other operations upon the perineal region, as on account of the influence which they are supposed to exert, under certain circumstances, upon the evacuation of the urine and the introduction of the catheter. Of these two strata, one is perpendicular in its direction, and descends from the pubes, the other is horizontal, and passes inwards from the ramus of the ischium, both being connected with the membranous portion of the urethra.

The transverse muscle, which is usually more distinct than the other, and which is now generally known under the name of the *compressor muscle* of the urethra, although noticed by Santorini, was first accurately described, in 1834, by Mr. Guthrie, of London, in his excellent work on the Urinary Organs. From its situation and direction, it might, with great propriety, be called the deep transverse perineal muscle, in contradistinction to the superficial. It arises, by a narrow aponeurosis, from the posterior aspect of the ascending ramus of the ischium, a little below its junction with the descending ramus of the pubes. From this point its fibres, which soon become fleshy, pass transversely across the perineum, with a slight inclination upwards, as far as the membranous portion of the urethra, where they separate into two slips, one of which is expanded upon the upper, the other upon the lower surface of the tube, which they cover in its entire extent from the bulb to the prostate. The muscle, at its insertion, exhibits a fan-like arrangement, and is frequently connected, by a sort of tendinous raphé, with its fellow of the opposite side. The inferior slip lies over Cowper's gland, Fig. 1. In the female, the compressor has a similar arrangement precisely as in the male. It is often very faintly developed in both sexes: I have found it wanting on one side.

The perpendicular muscle, or, as it has been appropriately named from its attachments, the *pubo-urethral*, was particularly described in 1809 by the late Mr. James Wilson,¹ an eminent anatomist of London. It is of a triangular shape, and arises, by a round, narrow tendon, from the posterior part of the pubic symphysis, about one-eighth of an inch from its fibro-cartilage, and nearly the same distance below the attachment of the anterior vesical ligament. It

¹ London Medico-Chir. Trans., vol. i. p. 176.

descends vertically along the median line, gradually increases in breadth, and is connected, on the membranous portion of the urethra, with the upper slip of the compressor muscle. The probability is that this muscle is only a part of the anterior fibres of the elevator muscle of the anus. Wilson describes it as passing round the urethra, and as forming with its fellow a sling for supporting it.

The two muscles now described are considered by some anatomists, not as separate and distinct, but merely as so many parts of a single structure. The account here given of them, however, seems to me, on the whole, to be more consonant with what obtains in other parts of the muscular system. The functions of these muscles are sufficiently evident. When both compressors act together, they can diminish the canal of the urethra, and, perhaps, close it even entirely. If, on the other hand, only one acts, it may compress the tube slightly, and at the same time draw it outwards towards the corresponding ischium. The contraction of the inferior fasciculus doubtless assists in expelling the secretion of Cowper's gland. The office of the pubo-urethral muscle is to draw the membranous portion of the urethra upwards towards the arch of the pubes.

The pubo-urethral muscle is best seen in a dissection made from within the pelvis after the bladder has been turned down from its attachments to the pubes, and after the removal of the posterior layer of the deep perineal fascia. The compressor, on the contrary, is more easily approached in front. For this purpose the anterior lamella is carefully raised, and the spongy body of the urethra, separated from its connections for several inches, is drawn forwards to put the membranous portion, into which it is inserted, upon the stretch. A stout muscular subject should be selected for the dissection.

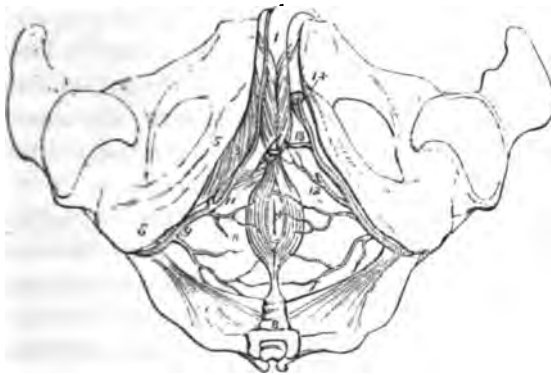
The *glands of Cowper*, Fig. 8, which may be appropriately considered along with the muscles just described, are situated deeply in the perineum, immediately beneath the membranous portion of the urethra, and just behind the anterior layer of the triangular ligament. They are two in number, are each about the size of a common pea, and are of a light rose, grayish, or pale yellowish color. In their shape they are generally rounded, but sometimes they are ovoidal, oblong, or nearly lenticular; their surface is rough and granulated, and their consistence strongly resembles that of a salivary gland. They are inclosed each in a thin fibrous investment, and are placed immediately under cover of the lower portion of the com-

pressor muscle, the contraction of which greatly promotes the expulsion of their secretion.

Cowper's glands are compound bodies, composed of lobules which are connected together by dense cellular substance, and which consist essentially of minute cells, opening into corresponding delicate canals. These soon unite and form the proper excretory duct, which passes forwards beneath the mucous membrane of the urethra for about three-quarters of an inch, and terminates by an oblique orifice upon the floor of the bulbous portion of the tube. These glands are often exceedingly small, and occasionally one or both are absent. They are sometimes divided in the operation of lithotomy, and they are liable to suffer from extension of gonorrhœal inflammation. They secrete a viscid, transparent fluid, the use of which is unknown. A third gland occasionally lies between them.

The structures of which the perineum consists are pervaded and nourished by a number of *arteries*, which, from their size and relations, claim the especial attention of the lithotomist. They are all

Fig. 4.



The arteries of the perineum : on the right side the superficial arteries are seen, and on the left, the deep. 1. The penis, the left leg of which has been removed. 2. The accelerator muscles. 3. The erector muscle of the penis on the right side. 4. The anus, with its sphincter. 5. The branches of the ischiatic and pubic bones. 6. The tuberosity of the ischium. 7. The lesser sacro sciatic ligament, attached by its apex to the spine of the ischium. 8. The coccyx. 9. The internal pubic artery, crossing the spine of the ischium and entering the perineum. 10. The external hemorrhoidal branches. 11. The superficial perineal artery, giving off the transverse perineal upon the transverse muscle. 12. The same artery on the left side, cut off. 13. The artery of the bulb. 14. The two terminal branches of the internal pudic artery, one of which is seen entering the divided extremity of the leg of the penis, while the other surrounds the dorsal surface of that organ.

derived from one common trunk, the internal pudic, which, therefore, requires to be considered first.

The internal *pudic artery*, Fig. 4, arises from the anterior division

of the internal iliac, either separately, or, as not unfrequently happens, by a trunk common to it and the ischiatic, which usually exceeds it a little in volume. Descending in front of the sciatic plexus of nerves and the pyriform muscle, it escapes from the pelvis at the inferior part of the great sciatic notch, but soon re-enters that cavity through the small sciatic foramen, turning round the spine of the ischium, and so applying itself against the inner surface of the tuberosity of that bone. From this point it runs forwards and upwards along the branches of the ischium and pubes, nearly to the level of the sub-pubic ligament, where it divides into its two ultimate branches, the dorsal artery of the penis and the artery of the cavernous body.

The internal pudic is usually described as consisting of three portions, but such an arrangement need not be adopted here, inasmuch as the vessel is of no special interest to the lithotomist until after it has re-entered the pelvis. The part which requires particular notice may be considered as extending from the inner margin of the small sciatic notch to the lower border of the sub-pubic ligament. The vessel included between these two points runs forwards and a little upwards in a gently curved direction, and is inclosed, with its nerve and vein, in a fibrous canal formed in the obturator fascia. It lies at first very deeply behind the tuberosity of the ischium, but as it proceeds towards its place of destination along the inner margin of the branch of this and the pubic bone, it gradually approaches the surface, and becomes comparatively superficial.

The varieties in the origin and course of the internal pudic artery are very important in a surgical point of view. When it arises at the usual spot, and pursues the direction above indicated, it is, in general, in no danger of being wounded in the lateral operation. Its deep position on the inside of the tuberosity and branch of the ischium is a sufficient protection against the knife, and indeed, in most cases, against the gorget and the lithotome. But when the artery inclines much towards the median line, or when its place is supplied by a supplemental vessel, running along the side of the bladder and the prostate gland, there will necessarily be considerable risk of hemorrhage.

When the pudic artery is unusually small, or when it is altogether wanting, the defect is generally compensated by a small vessel which has been recently described by Professor Richard Quain,¹ of

¹ *The Anatomy of the Arteries of the Human Body*, p. 443, London, 1844.

London, under the name of the *accessory pudic*, Fig. 5, though it had been previously noticed by other anatomists, as Burns, Meckel, Shaw, Monro, Velpeau, Spence, and Tiedemann, the latter of whom has beautifully delineated it in his magnificent plates. It is chiefly important in relation to the neck of the bladder and prostate gland, and the consequent bearing which it has upon the operation of lithotomy.

The accessory artery varies considerably in regard to its origin.

Fig. 5.



The accessory pudic artery. a. The prostate. b. The penis. c. The bladder. d. Seminal vesicle. e. The pubic bone. f. The rectum. g. The accessory artery, coursing along the side of the prostate.

Generally it is given off from the internal pudic itself, just before this vessel escapes from the sacro-sciatic foramen, and passes along the lateral and inferior surface of the bladder, the side of the prostate gland, and the membranous portion of the urethra, to gain the dorsal surface of the penis. In some instances, it lies upon the upper surface of the prostate gland; and occasionally, though rarely, it penetrates its substance. In the second place, the artery may arise from the internal iliac, and pursue the same course as when it is furnished by the pudic. Lastly, it may originate from the obturator or the epigastric. In either case, it descends immediately behind the body of the pubes, and is consequently in no danger of being wounded in the lateral operation.

An important variety in the course of the internal pudic has re-

cently been described by Mr. Coote,¹ of England. After re-entering the pelvis through the lesser sacro-sciatic notch, the artery, instead of ascending, as usual, behind the ramus of the ischium and of the pubes, passed on by the side of the rectum towards the triangular ligament, and separated into its three terminal branches, one of which was distributed to the bulb of the urethra, another to the root of the penis, and the third to the dorsal surface of the penis. Had lithotomy been performed upon this subject, the pudic artery would have been unavoidably divided. The anomaly existed on both sides.

The internal pudic artery, in its passage from the pelvis across the perineum, gives off a number of branches, most of which, if not all, are intimately concerned in the operation of lithotomy, and therefore require particular attention. They are named either from their direction, or from the parts to which they are distributed.

1. In examining these branches from below upwards, the first in order is the *inferior hemorrhoidal*. It is detached from the internal pudic about twelve lines behind the transverse perineal muscle, and consequently just before this vessel applies itself to the inner surface of the tuberosity of the ischium. Inclining inwards and slightly upwards, the hemorrhoidal artery runs across the ischio-rectal fossa, through the cellulo-adipose tissue in that situation, and is distributed to the inferior extremity of the rectum, the sphincter and elevator muscles, and the integuments about the anus.

The hemorrhoidal artery is sometimes double; and occasionally it is given off by the pudic just below the transverse perineal muscle. It is generally of small size, and is in no danger of being wounded in the lateral operation. It is only when it originates much higher up than usual that it is liable to be divided.

2. The *superficial perineal artery* is a long, slender vessel, lying in the fossa between the erector and accelerator muscles, on a line with the branches of the ischium and pubes. It arises from the pudic about six lines behind the transverse muscle, across which it runs as it ascends, and is finally spent upon the dartos, the scrotum, and the skin of the penis. In the early part of its course it is placed under cover of the superficial fascia, but as it proceeds upwards it gradually approaches the surface.

The superficial perineal artery is the most voluminous branch of the internal pudic; but it is fortunately seldom cut in the lateral operation. It is liable, however, to deviate from its natural direction,

¹ London Medical Times, Nov. 17, 1849.

and to incline more than usually towards the raphé of the perineum. In this case, which is by no means an unfrequent one, the lithotomist would find it difficult to avoid it. It sometimes gives off the transverse perineal artery.

3. The *transverse perineal artery* generally arises from the pudic, from four to six lines in front of the superficial perineal, of which it is sometimes an offset. Piercing the deep perineal fascia near its base, it runs horizontally inward along the posterior border of the transverse muscle, and terminates near the central tendinous point in several small twigs, which are distributed to the structures between the anus and the bulb of the urethra. It anastomoses with its fellow of the opposite side, and with the inferior hemorrhoidal arteries. This vessel is always cut in the operation of lithotomy; but owing to its small size it seldom bleeds so profusely as to require a ligature. It is sometimes double on one side; occasionally it is very small; and sometimes it originates much lower down than usual. In a case described by Belmas, it arose from the internal pudic just behind the lesser sciatic ligament, and extended forward over the bulb of the urethra across the lines of the lateral and bi-lateral operations. Its direction is generally transverse; but not unfrequently it inclines either obliquely upwards or downwards.

4. The *artery of the bulb* is a very short, thick, stunted branch, and is given off by the internal pudic opposite the inferior extremity of the crus of the penis. It passes horizontally inwards, between the layers of the triangular ligament, and ends near the margin of the opening which transmits the membranous portion of the urethra. Here it divides into two twigs, of which one descends a little, and is distributed to Cowper's glands, while the other, which is considerably larger, enters the bulb, and ramifies in the erectile tissue of the spongy body. This artery, surgically considered, is by far the most important branch of the pudic. When it is divided, as it not unfrequently is in the operation of lithotomy, it is liable to bleed profusely, and is generally secured with much difficulty, owing to the depth at which it is situated, and the great extent to which it retracts.

The artery of the bulb is liable to numerous variations, both as it regards its origin and direction. From their connection with the operation of lithotomy, these irregularities require special notice.

The vessel is sometimes unusually small, or defective in volume. A few examples are recorded of its entire absence on both sides. Occasionally it is wanting on one side, but present on the other. On the other hand, it is sometimes double, or its place is supplied

by two, three, or even four small twigs from the internal pudic. Instead of its usual origin and direction, the artery may take its rise far back near the tuberosity of the ischium, and proceed thence obliquely upwards and inwards towards the median line. When it pursues this course, it can scarcely fail to be wounded in the lateral operation. Instances have occurred in which it was furnished by the accessory pudic, much higher up than usual, where of course it would have been beyond the reach of the knife. Cruveilhier¹ mentions a case where it arose from the obturator artery. It ran along the inner part of the obturator foramen, crossed perpendicularly the posterior surface of the branch of the pubic bone, and then passed on horizontally forwards over the internal pudic, above which it lay, to the bulb of the urethra. This arrangement was limited to the left side. On the right side the artery was normal. In a subject dissected by Mr. Spence,² of Edinburgh, the artery was given off by the pudic as usual; but, instead of pursuing its accustomed route, it passed almost directly backwards nearly to the anus, from which it again curved upwards to enter the bulb. Finally, in two cases recorded by Mr. Stanley, of London, the vessel, coming off from the pudic, posterior to the usual point, ran immediately above the inferior margin of the triangular ligament, and then proceeded upwards to the urethra as under ordinary circumstances.

Such are the constituent elements of the perineum. Let us now inquire into a few practical facts connected with this region, particularly its depth, the extent of its base, and the distance between the bulb of the urethra and the anus.

The *depth* of this portion of the perineum, or the distance from the surface of the skin to the neck of the bladder, is subject to considerable diversity, depending mainly upon the degree of obesity of the individual. Attempts have been made to determine this point by actual admeasurement with the pelvimeter. The subject is of great interest in relation to perineal lithotomy. When the depth is unusually great, the operator may fail to divide the prostate to the requisite extent, or his knife may slip from the groove of the staff, and pass between the bladder and the rectum, wounding, perhaps, the latter before he completes his random incisions. Aware of the variations which the part presents in different individuals, he will not be likely, if he meet with any unexpected deviation, to be thrown

¹ The Anatomy of the Human Body, edited by Dr. Pattison, p. 555. New York, 1844.

² Edinburgh Monthly Journal of Med. Science, No. 111.

off his guard, but to proceed as if nothing had happened. Dupuytren, whose examinations were conducted with much care, found the depth of the perineum, in twenty-three well-formed adult subjects, to range between fourteen lines and four inches, the average being nearly two inches and a quarter. The least depth usually occurs in the leanest subjects, or in those who have suffered long and much from calculous irritation. In children from three to five years of age, I have repeatedly found the distance between the two points in question to be upwards of two inches.

The *extent* of the urethral portion of the perineum, or the distance between the tuberosities of the ischiatic bones, is also liable to individual disparity. In the recent subject, it rarely exceeds two inches and three-quarters, which is increased, in the dried skeleton, from one and a half to three lines. Dupuytren, in the twenty-three cases already alluded to, noticed that the distance ranged from two inches to three inches and a half. In certain varieties of pelvic deformity, the width is sometimes considerably diminished. Velpeau has occasionally found it as short as an inch and three-quarters. In a case published by Dr. Roberts, of Paris, the space between the branches of the ischiatic and pubic bones did not exceed six lines. A narrow perineum must necessarily form a great hinderance to the extraction of a stone, if not also to the performance of lithotomy.

The *external surface* of the perineum varies somewhat in its appearance in different portions of its extent. Superiorly, it is convex from side to side, owing to the situation of the bulb of the urethra, which, being often remarkably prominent, throws out the part in bold relief. Further down, as we approach the ischiatic tuberosities, it is somewhat excavated, depressed, or flattened, especially at the anus. The interval between the bulb and the anus, the recto-urethral triangle, as it is named, is liable to considerable variety, and has claims upon the attention of the surgeon, on account of the influence which it must exert upon the length of his incisions. Ordinarily, it does not exceed eight or ten lines; but sometimes it is much diminished by the projection forward of the gut. This occurrence will be more likely to happen in persons in whom the lower bowel has been for a long time habitually distended with fecal matter. Under such circumstances, it occasionally becomes remarkably convex in front, and approaches the bulb much nearer than in the normal state. Furthermore, it is worthy of remark that the bulb itself may be inordinately prominent, and thus seriously encroach

upon the space under consideration. In aged persons, especially in such as have suffered much from calculous irritation, some degree of swelling may be produced by the engorgement of the venous plexus of the part. When, from either cause, this space is materially diminished, both the bulb and the rectum will be in danger of being wounded in the operation of lithotomy.

The inferior region of the perineum, or the *ano-perineal* compartment, possesses but little interest to the lithotomist, and does not, therefore, require minute notice in a work of this nature. The most important objects included in it are the anus, the ischio-rectal fossa, and the inferior portion of the rectum.

With the situation of the *anus* every one is familiar. It is a dilatable opening, covered partly by skin and partly by mucous membrane, and encircled by two muscles, which, from their position and functions, are called the external and internal sphincters. These two muscles deserve brief notice here, from the fact that they are always divided in the recto-vesical operation of lithotomy. A few of the fibres of the external one are also sometimes cut across in the lateral section. When the anus is in a state of repose, the distance between it and the tuberosity of the ischium, on each side, is nearly one inch and a half, and hence it is generally sufficiently out of the way of the knife in the operation just mentioned. But, during the straining which so frequently ensues while the patient is on the table, either just before or immediately after the incisions have been commenced, the bowel is exceedingly apt to protrude, and to press the edges of the orifice outwards towards the ischiatic bones, thereby materially lessening the interval between them, and endangering the tube. The inconvenience resulting from this occurrence is sometimes so great as to compel the operator to push back the prolapsed parts with his fingers, and to wait a few minutes, until the spasmodic action, on which it depends, has subsided. If he omit this precaution, or fail to lateralize the knife more than usually, he will be very likely to wound the bowel long before he reaches the bladder.

The *external sphincter* lies immediately beneath the skin; it is of an elliptical figure, and completely encircles the anus, the two bundles of which it is composed being united with each other at the middle line. Anteriorly it is attached to the central tendinous raphe of the perineum, and posteriorly to the tip and back of the coccyx, by a narrow cellulo-fibrous band, about one inch in length. The fibres of the muscle, which are generally of a florid color, extend

about twelve lines beyond the lateral margin of the anus, a short distance over into the ischio-rectal gutter, and are much more distinct and strong in some subjects than in others. Their deep surface is in relation with the internal sphincter muscle and a small quantity of cellular tissue.

The *internal sphincter* muscle surrounds the lower part of the rectum, in the form of a belt. It is situated an inch above the anus, and is two lines thick, by a little more than six lines in height. Its fibres, which are paler than those of the external sphincter, are continuous above with the circular fibres of the rectum, of which, in fact, they form a part, the only difference between them being that they are more closely and numerously aggregated together.

Between the ischium and the rectum is a deep hollow, which, in the recent state, is occupied by a large quantity of cellulo-adipose substance. It has been described by Velpeau, in reference to its situation, under the name of the *ischio-rectal fossa*, and is deserving of notice here chiefly on account of the large abscesses which are liable to form in it. The knife likewise traverses it in the lateral operation of lithotomy. When this cavity is cleared of its fat, it is found to be of a triangular figure, the base of which corresponds to the skin, and the apex to the angle formed by the union of the fibres of the elevator muscle of the anus and the obturator fascia. It is bounded, posteriorly, by the great gluteal muscle, anteriorly by the transverse muscle, internally by the elevator muscle and the pelvic aponeurosis, and externally by the tuberosity of the ischium.

The surgical anatomy of the bladder, urethra, prostate gland, and perineum, would be incomplete without a brief account of the *rectum*, which is so intimately related with them, especially in the lower portion of its extent. The division of the alimentary canal to which this name is applied, is about twelve inches in length, and reaches from the sigmoid flexure of the colon to the anus, in which it terminates. Anatomists usually describe it as consisting of three portions, a superior, a middle, and an inferior, of which only the last two are of any particular surgical interest.

The middle portion of the reservoir is situated behind the bladder, in contact with the sacrum and coccyx; it is nearly horizontal in its direction, and is from three and a half to four inches in length. Its anterior surface, in the upper part of its extent, is covered by peritoneum; further down, it lies in close relation with the seminal vesicles, the deferential tubes, and a small portion of the bas-fond of

the bladder; and towards its termination it is in contact with the prostate gland and the commencement of the membranous portion of the urethra. "The remainder of this portion of the intestine lies imbedded in a quantity of cellular and adipose tissue, and receives an investment from the pelvic fascia, which maintains it fixed in its position upon the sacrum and coccyx." When the tube is unusually capacious, whether as a result of congenital formation, or of habitual distension, it occasionally projects considerably outwards, so as to overlap the sides of the bladder and the prostate gland, and be in danger of being injured during the division of the latter organ in the operation for stone.

The inferior portion of the bowel extends from the extremity of the coccyx to the anus; it inclines obliquely downwards and backwards, and is from an inch and a quarter to an inch and a half in length. More capacious above than below, it is surrounded by the fibres of the elevator muscles of the anus, and is strengthened, in front, by a prolongation of the deep perineal ligament, which thus aids in keeping it in its place. Between this portion of the rectum and the bulb of the urethra is a deep, narrow recess, which, from its shape and connections, is called the *recto-urethral triangle*, the base of which corresponds with the cutaneous surface of the perineum, and the apex with the anterior extremity of the prostate gland. This space is occupied by cellulo-adipose tissue; and its chief surgical interest relates to the bilateral operation of lithotomy, the first incisions of which are carried across it.

The middle portion of the rectum is connected with the base of the bladder and the prostate gland by a layer of cellular substance, which is quite lax in its texture, and liable to slight serous infiltration, when, from any cause, it becomes the seat of severe irritation. In protracted cases of stone, when the irritation is propagated from the bladder to this tissue, it is occasionally a good deal thickened, and so much condensed as to grate under the knife. The soft, lax character of this tissue explains the facility with which the gorget and the forceps are thrust between the bladder and the bowel, in operating for stone, detaching them extensively from each other, and so placing the parts in a condition favorable to the lodgement of the urine. The same circumstance enables us to account for the ease with which, in cases of tight, callous strictures, or false passages, a catheter, bougie, or sound may be forced on beyond the prostate gland and the neck of the bladder, much to the detriment of the patient and the embarrassment of the surgeon.

No large arteries exist in the two portions of the bowel here described, and hence the occurrence of hemorrhage need seldom be dreaded in any of the recto-vesical operations. It is only when the parts are indurated from inflammatory deposits, and when, consequently, the vessels, when divided, are unable to retract, that anything like serious bleeding is to be apprehended; but even then it may generally be promptly arrested by compression and cold applications. In old subjects, affected with piles, fistule, or stone, there is frequently an enlarged and varicose state of the hemorrhoidal veins, which, when divided, occasionally furnish a considerable flow of blood.

CHAPTER II.

ANATOMY OF THE URINARY BLADDER.

THE bladder is a musculo-membranous bag, which, serving as a reservoir for the urine, communicates, on the one hand, with the ureters, and on the other with the urethra, the common outlet of this and the seminal fluid. It is situated in the anterior and middle part of the cavity of the pelvis, and varies in its position as well as in its shape, according as it is empty, partially filled, or thoroughly distended. When it is in a contracted condition, as it usually is after death, it is of a flattened, triangular form, the apex being directed towards the pubic symphysis, and the base towards the rectum. When it is distended, however, it mounts up into the hypogastric region, and assumes an elongated cylindrical figure, its summit inclining upwards and forwards, the larger extremity downwards and backwards. Hence, the axis of the organ would coincide with a line drawn from the linea alba, midway between the pubes and the umbilicus, to the inferior extremity of the coccyx. In order to obtain an accurate knowledge of the general configuration of the bladder, and of its relations to the surrounding structures, it should be moderately distended with air or water; the penis should then be tied, and one side of the pelvis removed; the rectum, and the lower half of the anterior wall of the abdomen, should be left undisturbed. When this has been done, it will be found that the organ lies in contact, anteriorly, with the pubic bones and the straight muscles; supe-

riorly, with the folds of the small intestines; posteriorly, with the rectum; and inferiorly, with the prostate gland and the seminal

Fig. 6.



Side view of the pelvic viscera of the male, in their natural situation. 1. The divided surface of the pubic bone. 2. The divided surface of the sacrum. 3. The body of the bladder. 4. Its fundus, with the urachus at its apex. 5. The base of the bladder. 6. The ureter. 7. The neck of the bladder. 8, 8. The pelvic fascia. The anterior vesical ligaments are seen just above figure 7. 9. The prostate gland. 10. The membranous portion of the urethra. 11. The triangular ligament, formed of two layers. 12. One of Cowper's glands. 13. The bulb of the spongy body. 14. The body of the spongy structure. 15. The right leg of the penis. 16. The upper part of the first portion of the rectum. 17. The recto-vesical fold of the peritoneum. 18. The second portion of the rectum. 19. The right seminal vesicle. 20. The deferent duct. 21. The rectum, covered by the descending layer of the pelvic fascia. 22. A part of the elevator muscle of the anus. 23. The external sphincter muscle. 24. The interval between the deep and superficial perineal fasciæ: they are seen to be continuous beneath the number.

vesicles. In the very young subject, the bladder is contained almost wholly in the cavity of the abdomen, and is of a pyriform figure, with the base towards the umbilicus. As the pelvis enlarges, however, it gradually sinks down into that cavity, and becomes moulded, as it were, into the shape which characterizes it in after life, by the pressure of the superincumbent viscera. In the female, the organ corresponds below with the vagina and the uterus. It differs also considerably from that of the male, not only in being more capacious, but in being flattened in the antero-posterior direction, and expanded at the sides. These changes are not primitive but acquired, and depend, the first, upon the habit which women have of retaining their urine much longer than men, and the second, upon the manner in which the bladder is wedged in between the uterus and the wall of the abdomen during pregnancy.

The relations of the bladder are, as was previously stated, mate-

rially influenced by its state of repletion or vacuity. When the organ is distended to its utmost with air, it projects outwards, in every direction, towards the walls of the pelvis, and ascends a considerable distance towards the umbilicus. To ascertain the changes which it experiences, under these circumstances, I made a careful examination of the body of a well-formed male, twenty years of age, and about five feet ten inches in height. The organ was inflated through the urethra, to as great an extent as was practicable, with the mouth applied to a silver catheter, and, during the progress of the distension, care was taken to remove the innominate bone of the left side, to enable me the better to determine the relations of its inferior parts. It should be added that the small and large bowels were nearly empty.

The bladder mounted five inches above the top of the pubic symphysis, and carried up the peritoneum precisely two inches and a half from this point, or, what is the same thing, it left the organ uncovered by serous membrane to this extent in front. Its anterior surface was quite convex, and lay in close contact with the posterior surface of the straight and pyramidal muscles, which did not, however, completely cover it. The width of this surface, at its middle and broadest part, was four inches and a half.

The posterior surface, also quite convex, projected against the promontory of the sacrum, in such a manner as to allow nothing to intervene between them. Lower down it lay upon the rectum, which was entirely empty, and, as it were, compressed by it. The commencement of the rectum was a little to the left side of the bladder, and was also in contact with, but not much compressed by it.

The sides of the organ were convex, and in contact with the parietes of the pelvis and the great vessels, the external iliac arteries and veins forming its superior boundary. On the right side, in a sort of pouch, or cul-de-sac, the bladder was in apposition with the cæcum; and somewhat lower down and considerably further back, was the vermiform appendage of the colon. The remainder of the lateral surface was in relation with the small bowel. On the left side, the organ was everywhere in contact with the folds of the ileum. On both sides, a little in front of the middle of the organ, was the epigastric artery, with its two veins, on its way towards the umbilicus. The distance, on each side, between the bladder and the antero-superior spinous process of the ilium, was two inches and a quarter.

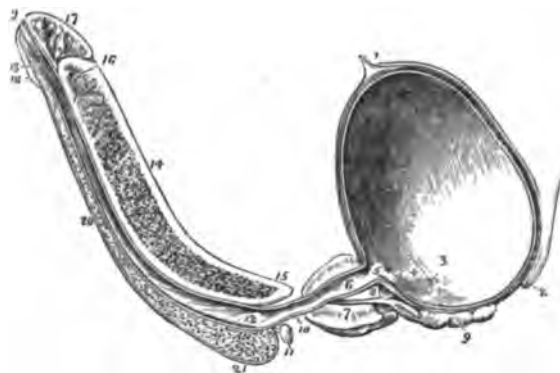
The top of the viscus, or the superior fundus, as it has been named, rounded and convex, was in contact with the folds of the small intestines, and reached to within two inches of the umbilicus.

The finger, introduced into the rectum, received a distinct impulse on percussion of the hypogastrium, and, in turn, imparted, when pressed against the bas-fond of the viscus, a distinct impulse to the hand upon the hypogastrium.

The bladder is retained in its position by several folds of the peritoneum, and by the reflection of the pelvic fascia, the former constituting what are called the false, the latter the true vesical ligaments. In describing the exterior conformation of this organ, and its relation to the adjacent parts, it will be necessary, for the sake of accuracy of detail, to consider it as being divisible into a body, neck, base, and summit; premising that it is distended in the manner above stated.

The *summit* of the bladder, called by some anatomists the *superior base*, or upper fundus, is of a rounded, convex form, and is directed

Fig. 7.



Longitudinal section of the bladder, prostate, and penis, exhibiting the urethra. 1. The urachus. 2. The recto-vesical fold of the peritoneum, at its point of reflection from the base of the bladder. 3. The orifice of the right ureter. 4. A slight ridge between the ureter and urethra, forming the lateral boundary of the vesical trigone. 5. The commencement of the urethra. 6. The prostatic portion. 7. The prostate. 8. The middle lobe. 9. The right seminal vesicle. 10. The membranous portion of the urethra. 11. Cowper's gland of the right side. 12. The bulbous portion of the urethra. 13. The navicular fossa. 14. The cavernous body. 15. The right leg of the penis. 16. The pectiniform septum. 17. The base of the gland. 18. The lower segment of the gland. 19. The urinary meatus. 20. The spongy body. 21. The bulb of the urethra.

obliquely upwards and forwards, being in contact, anteriorly, with the straight muscles of the abdomen, and, posteriorly, with the con-

volutions of the small intestines. When the viscus is much distended, this part will be found occasionally to incline somewhat to the left side; a fact already known to some of the earlier anatomists. It is fixed to the wall of the abdomen by the superior false ligament, by the urachus, and by the obliterated umbilical arteries; the portion in front of these structures being unprovided with a serous investment.

The *base* of the bladder is the lowest and most dependent part of the sac. In the male, it corresponds with the rectum, the seminal vesicles, and the deferential ducts; in the female, with the vagina and the inferior half of the neck of the uterus. It is bounded, posteriorly, by the recto-vesical septum; anteriorly, by the prostate gland; and, on each side, by the lateral surface of the organ, with which it is insensibly confounded. Hence, its dimensions are nearly equal in every direction, the widest part, however, being behind. The seminal vesicles, as they extend from before backwards, divide this space into three surfaces, one being placed on each side, the other intermediately. Each lateral surface is convex, and somewhat broader in front than behind; the middle, on the contrary, is flattened, and much wider behind than before, being strictly triangular in its shape. This surface lies in close contact with the rectum, being separated from it merely by a small quantity of cellular substance and a few small convoluted veins, and is particularly deserving of attention, as it is the spot which is always selected for the recto-vesical puncture in obstinate retention of urine.

In its distended condition, the base of the bladder is destitute of a peritoneal investment, and may then be approached without fear of wounding this important structure. When, however, it is empty, or nearly so, the membrane descends some distance over the space between the seminal vesicles and the deferential tubes, and thus separates the viscus from the rectum. The peritoneum, as it is reflected off from the bowel to the posterior surface of the bladder, forms a strong cul-de-sac, the edges of which are elevated into two sharp crescentic folds, known as the *posterior vesical ligaments*.

The *body* of the organ is the part which intervenes between the base and the summit, and, in its shape, is not unlike a small flask. Although strictly cylindrical in its outline, it may be considered as presenting four surfaces, two lateral, an anterior, and a posterior.

The *anterior surface* extends from the summit to the neck of the reservoir, and is consequently, in the healthy adult state, from four

to six inches in length; ascending, however, not unfrequently, when the viscus is fully distended, nearly as high up as the umbilicus. It is placed immediately behind the pubic symphysis and the straight abdominal muscles, from which it is separated only by a small quantity of cellulo-adipose tissue. As this surface is always uncovered by the peritoneum, at least when the bladder is pretty well filled, it may be punctured with safety in the high operation for stone and for the evacuation of the urine, in case of retention, complicated with great enlargement of the prostate gland, or serious disease of the lower bowel.

The *posterior surface* is in contact with the rectum in the male, with the uterus in the female, and, in both sexes, occasionally with the folds of the small intestines; it is convex, smooth, and invested, in its whole extent, by the peritoneum.

The *lateral surfaces* of the bladder, considerably wider below than above, are contiguous to the sides of the pelvis, and to the elevator muscles of the anus, to which they are connected by a large quantity of cellular substance. Along the back part of each of these surfaces are the deferential duct and the obliterated umbilical artery, the former of which is inclosed in a fold of peritoneum, denominated the *lateral ligament* of the bladder. This fold, extending outwards towards the side of the pelvis, may be considered as answering the same purpose to the urinary reservoir that the broad ligament does to the uterus, both being apparently designed rather to permit these organs to distend themselves than to check their motions. The two lateral surfaces are not entirely covered by the peritoneum, but only so much of them as lies posterior to the deferential ducts; it being understood, of course, that the sac is not empty, but filled with air or fluid.

The *neck* of the bladder is situated at the anterior and inferior part of the organ, and may be likened to the faucet of a cask standing on its bottom. In its shape it represents a truncated cone, the base of which looks backwards, while the apex terminates in the urethra. Its position, in the adult, is very nearly horizontal; but in the young subject it inclines obliquely downwards and forwards. The posterior part of it rests on the rectum, while the anterior is embraced by the prostate gland. The neck of the bladder is cut in the operation of lithotomy by the perineal method.

To complete the account of the exterior of the bladder, it is necessary to describe its *fascia* and *true ligaments*. To do this, it is

proper to premise that the pelvic aponeurosis, as it is termed, lines the inner surface of the elevator muscle of the anus, lying between it and the peritoneum, and extending as low down as on a level with an oblique line stretched from the inferior edge of the pubic symphysis to the spine of the ischium. At this point the membrane leaves the wall of the pelvis to be prolonged upon the side of the bladder and the prostate gland, with the structure of which it is in some degree identified. Posteriorly, it becomes attached to the lateral aspect of the rectum, and gradually degenerates into a thin cellular lamella, which is lost on the vessels and nerves passing out at the pelvis. This structure, it may now be observed, forms what is called the *vesical fascia*; and that portion of it which extends from the wall of the pelvis to the side of the bladder is the *true lateral ligament* of this organ. This band is calculated not only to restrain the motions of the bladder, but as it forms a kind of pouch on each side of it, it assists materially in closing up the pelvis, and in warding off the pressure of the abdominal viscera.

If the pelvic fascia be traced along the posterior part of the pubic symphysis, it will be found to be reflected from thence upon the neck of the bladder and the upper surface of the prostate gland, in the form of two dense, narrow, whitish bands, hardly an inch in length. These are the *anterior vesical ligaments*; they are stretched along each side of the middle line, and being of great strength, they assist materially in sustaining the bladder in its proper position. A small depression, a sort of cul-de-sac, exists between these two bands, large enough to receive the point of the forefinger; it is formed by the junction of the two fasciæ of the opposite sides, and serves to connect the middle and upper part of the bladder to the inferior margin of the pubic symphysis. It is occupied, in the natural state, by a small quantity of cellulo-adipose matter, and corresponds with the upper surface of the membranous portion of the urethra, the prostate gland, and the continuation of the dorsal veins of the penis.

The *urachus*, to which allusion has already been made, is a thin, rounded cord, of a conical shape, extending from the centre of the summit of the bladder to the umbilical cord, where it terminates in a kind of cul-de-sac. As it proceeds upwards, it lies in close contact with the linea alba, being bounded on each side by the obliterated umbilical arteries, and enveloped partially by the peritoneum. In early foetal life, the urachus contains a narrow central canal, hardly as large as a bristle, which communicates with the umbilical cord,

and is generally effaced a short time before birth. It is evidently composed of the same structures as the bladder; but its use in the human subject is not very obvious.

The urachus sometimes remains hollow for a long period after birth, if not, indeed, during the whole of life. When this is the case, it occasionally forms an outlet for the urine, which, instead of passing off by the natural channel, is discharged at the umbilicus. This circumstance, which has been noticed both in new-born children and in adults, is, of course, exceedingly rare, and is always associated with occlusion of the urethra. It has also been known, in this condition, to give lodgement to urinary concretions. Of this occurrence, quite a number of examples have been witnessed by observers; but the most interesting one is that related by Boyer of a young man of twenty-six. The cavity in the urachus was an inch and a half in length, and contained twelve concretions of the volume of a millet-seed. One of them, larger than the rest, resembled a grain of barley. From the account of the French surgeon, it would seem that these calculi were actually lodged in the urachus, and not, as might at first be supposed, in a tubular prolongation of the bladder.

In June, 1850, Thomas Paget, Esq., of England, communicated to the Royal Medical and Chirurgical Society of London a case in which the urachus remained open, and a ring-shaped calculus, formed on a curved hair in the bladder, was extracted through the umbilicus.¹ The patient, a man aged forty years, had suffered upwards of twelve months from frequent and painful micturition. The stone was readily detected by sounding; the urine frequently escaped at the navel, especially during violent efforts at work, and a catheter, introduced into the bladder through the urethra, was easily made to appear at the abnormal opening. The man could retain a pint of urine at a time. The malformation, which existed from birth, was associated with an umbilical hernia of the size of a goose-egg. The calculus was seized with the finger carried at full length into the unnatural passage, dragged to the side of the bladder, and extracted at the umbilicus.

Leaving the exterior of the bladder, and going into its interior, various objects present themselves, possessing a deep surgical, as well as no little physiological interest. Of these, the most important

¹ American Journ. of Med. Science, Oct., 1850, p. 490.

are the mouth of the urethra, the orifices of the ureters, the vesical trigone, the uvula, and the bas-fond.

The *mouth of the urethra*, or, what is the same thing, the orifice of the neck of the bladder, is of a circular figure, not unlike that of a Florence flask; its lower surface, however, presents occasionally a crescentic appearance, more especially if the middle lobe of the prostate gland is more than ordinarily prominent. The mucous membrane here is very smooth, vascular, and sensitive; and the circular fibres of the muscular tunic are so closely aggregated together that Sir Charles Bell has been induced to regard them as forming a distinct *sphincter muscle*. However this may be, it is certain that these fibres often exert a powerful influence in spasmodic retention of urine, the flow of which they greatly impede, if not entirely prevent, by their action.

The cavity of the neck of the bladder, viewed from within, varies in its dimensions at different periods of life. Its diameters, measured at its base and summit, in subjects of different ages, are thus stated by Belmas:—¹

Age.		Base.	Summit.
From	8 to 8 years,	8 lines.	1½ lines.
"	8 to 16 "	4 "	2 "
"	16 to 40 "	5 "	2 "
"	40 to 60 "	6 "	3 "

It will thus be perceived that, in the old, the capacity of the vesical neck at its summit does not augment in proportion to that of its base; whence it follows that the incision of the urethral extremity of the prostate in the lateral operation ought to be proportionally larger.

The *orifices of the ureters* are situated at the posterior part of the vesical triangle, their direction being obliquely downwards and inwards. Lying about an inch and a half from each other, they are of a parabolical figure, and large enough to admit, without much difficulty, the end of an ordinary pocket director. Each opening is furnished with a small slip of fleshy fibres, extending obliquely downwards and inwards, beneath the mucous membrane, as far as the uvula of the bladder, into which it is inserted, and where it unites with that of the opposite side. The office of these little muscles, if they deserve the name, is supposed, by Sir Charles Bell, by whom they have been particularly described, to be that of dilating the orifice of the ureters, to enable these tubes to throw their con-

¹ *Traité de la Cystotomie Sus-pubienne*, p. 72.

tents more easily into the bladder. It is worthy of remark, in reference to the subject of retention of urine, that if the muscular coat of the bladder be entirely removed, and the ureters dissected up, the organ, when inflated, will still retain its contents. When the distension, however, from urine is very great and protracted, the orifices of these tubes are dilated, and regurgitation of the fluid is permitted.

The *vesical trigone* is the smooth surface at the bottom of the bladder, between the mouth of the urethra and the orifices of the ureters. As its name implies, it is of a triangular form, the base being behind, and the apex in front. It is nearly horizontal in its direction, and is bounded by three imaginary lines, each of which is from an inch and a quarter to an inch and a half in length. The mucous membrane investing this portion of the bladder is pale, highly sensitive, smooth, and so firmly adherent to the subjacent tunic as not to admit of corrugation. The trigone is somewhat larger in the female than in the male, in the latter of whom it corresponds to the triangular interval between the seminal vesicles, the spot selected by the surgeon for the recto-vesical puncture.

The *uvula* of the bladder may be considered as forming the anterior boundary of the trigone. It was first observed by Lieutaud, and is merely a slight elevation of the mucous membrane, caused by the projection of the middle lobe of the prostate. When this portion of the gland becomes much enlarged, as it often does in old people, the uvula may encroach so far upon the mouth of the urethra as to obstruct the flow of urine, as well as to oppose a serious impediment to the introduction of the catheter. In the bladder of the young subject, no uvula exists; nor is it always present in old persons.

The *bas-fond* is that portion of the floor of the bladder which lies behind the prostate gland. It is a very vascular, sensitive surface, and is particularly interesting in a surgical point of view, from the fact that in advanced life, and occasionally even at a comparatively early period, it is liable to be dilated into a sort of cup-like depression, situated considerably beneath the level of the mouth of the urethra, and consequently well calculated to serve as a receptacle to the urine, when, from any cause, it is partially but permanently retained. Calculi are also liable to lodge in it, and so to elude the sound and the forceps. To remedy this difficulty, it is necessary, as will be stated elsewhere, to carry the finger into the rectum and elevate the sac.

The *structure* of the bladder resembles that of the other hollow

viscera. Like them, it is composed of three tunics, a serous, a muscular, and a mucous, which are united together by cellular tissue. The cellular substance between the middle and inner membranes presents itself in the form of a thin lamella, which the older anatomists regarded as a distinct coat, but which is not usually so considered at the present day.

The *serous coat*, the outermost of the three, is merely a reflection of the peritoneum, and forms, as has been already seen, only a partial investment for the organ, nearly the whole of its base and anterior surface, together with a part of its sides and summit, being uncovered. It has a smooth, polished aspect, and is so loosely connected to the muscular tunic as to be separated from it without difficulty. This arrangement is evidently intended to facilitate the free motion of the bladder underneath during the process of distension.

The *muscular tunic* consists of strong, reddish fibres, arranged into two strata, closely connected by cellular tissue. The fibres of the external lamella are directed, for the most part, longitudinally, and appear to extend from the neck of the bladder to its summit; they are stronger in front and behind than at the sides of the viscus, where they usually pursue an oblique course, and are spread out in a very irregular manner. The fibres of the internal layer are nearly all arranged transversely; they are particularly well marked round the neck of the bladder, and, as they are so disposed here as to encircle the organ, they may be considered as forming a kind of sphincter muscle. The arrangement here mentioned can be most distinctly shown by everting the bladder, and dissecting off the mucous membrane immediately behind the orifice of the urethra. Some anatomists speak of a third stratum of fibres, situated internally to the preceding, and presenting a reticulated appearance. It is doubtful, however, whether this disposition is not altogether the effect of disease; it is certain, at any rate, that it is never so distinct as in hypertrophy of the muscular coat.

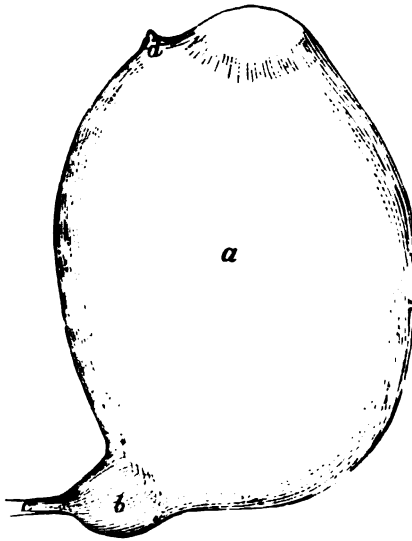
Between the muscular and mucous tunics is a layer of dense, cellular tissue, serving to unite them intimately to each other. It possesses considerable strength and firmness, is highly elastic, and does not admit of serous infiltration, or deposits of fatty matter. It plays a very important part in certain diseases of the bladder, and is interesting, moreover, as constituting the so-called *nervous tunic* of the older anatomists.

The *mucous coat* is of a pale reddish complexion, very extensible, and marked, in the collapsed state of the organ, by numerous wrin-

kles, which are effaced during distension. Its mucous follicles, although very abundant, are so small that it is very difficult to detect them in the sound condition; in some diseases, however, their presence is rendered very manifest. The internal coat is highly vascular and sensitive, and is intimately connected with the muscular one by the cellular lamella above described. It is continuous, on the one hand, with the mucous lining of the urethra, and on the other, with that of the ureters.

The bladder receives its arteries from the umbilical, internal pudic, ischiatic, middle hemorrhoidal, obturator, and hypogastric: in the female, the spermatic also furnish a few small branches. These vessels are distributed to different parts of the organ, but the greater number terminate upon its base and neck; they all inosculate freely with each other, and thus form an elegant network placed immediately beneath the peritoneal investment. The veins of the viscus pursue very nearly the same course as the arteries; they open into the iliac veins, and are particularly abundant at the lower and lateral aspect of the organ, where they form an intricate interlacement,

Fig. 8.



Bladder and prostate of a child of two years—from a dissection by the Author. *a.* Bladder. *b.* Prostate, natural size. *c.* Membranous portion of the urethra. *d.* Ureachus.

which is often remarkably conspicuous in old persons, especially in such as have suffered a long time under stone, stricture, or prostatic

disease. The lymphatic vessels, which are very numerous, terminate in the hypogastric ganglions. The nerves arise from the sacral plexus and the inferior extremity of the great sympathetic; the branches of the former presiding, in all probability, over the irritability of the organ, the others over its sensibility. This peculiar nervous supply also accounts for the mixed character of the functions of the bladder, which are partly voluntary, partly involuntary.

The bladder appears to be *developed* at an early period of uterogestation. Originally of an elongated, cylindrical shape, not unlike a small intestine, it is prolonged as high up as the umbilicus, where it communicates, by means of the urachus, with the allantoid vesicle of the foetal cord. While it continues in this extra-pelvic situation, the organ has no *bas-fond*, properly so termed, nor is there any well-defined line of demarcation between it and the urethra. As soon, however, as the urachus becomes closed, a circumstance which generally happens during the latter stages of pregnancy, the bladder begins slowly to descend, and, as the pelvic cavity enlarges, it gradually subsides into it; assuming, though not until some time after birth, the form and position belonging to it in adult life.

CHAPTER III.

ANATOMY OF THE PROSTATE GLAND.

THE prostate is a large, firm, follicular body, situated at the neck of the bladder and the commencement of the urethra, the latter of which either runs in a deep groove along its superior surface, or is entirely embedded in its substance. It lies behind and below the pubic symphysis, between it and the rectum, being intimately attached to both of these structures by cellular and other substance. Its position is a little oblique, and its axis, therefore, is directed downwards and forwards. The distance of the gland from the pubic symphysis varies from three to six lines, according to the age of the subject and the dimensions of the pelvis. In the adult it does not, in general, exceed half an inch. In its shape, the prostate resembles a Spanish chestnut, or the ace of hearts on a playing card; it is narrow in front, where it is truncated, rounded at the sides, and broad behind, where it is slightly notched at the middle. In infancy

and early childhood, the situation of the gland is a good deal more oblique than it is in adults.

Fig 9.



Postero-lateral view of the prostate and bladder, from a dissection by the author. *a.* Prostate gland. *b.* Membranous portion of the urethra. *c.* Rectum, drawn off from the prostate. *d.* Bladder. *e.* Seminal vesicle. *f.* Deferent tube. *g.* Triangular ligament of the urethra.

The relations and connections of this body are of great surgical interest, and should, therefore, be well understood by the practitioner. It is usual, for descriptive purposes, to consider it as consisting of two surfaces, two sides, a base, and an apex.

Of the two surfaces, one is anterior and the other posterior. For the sake of greater clearness, however, it is better to call them pubic and rectal, more especially as the terms superior and inferior have also been applied to them, and thus have led to much confusion.

The rectal surface is nearly flat, and is marked by a superficial groove, which extends vertically along the median plane, and serves to indicate the line of junction of the two lateral lobes. As its name implies, it corresponds with the rectum, to the anterior wall of which it is closely connected by dense cellular substance, in which there is never any fat or serum. If the finger be introduced into the gut, it will be found that the space between it and the prostate is very

limited, and that the outline of the latter can, in general, be pretty distinctly defined, especially when the organ has attained its full development. It is for this reason that the surgeon usually avails himself of this mode of investigation when he is desirous of ascertaining the real condition of the gland in case of disease.

The pubic surface is directed towards the pubic arch, to which it is firmly attached by the anterior vesical ligaments. It is a little shorter than the rectal surface, and is regularly convex, except along the median plane, where it presents a slight furrow, corresponding with the one behind. Its distance from the pubic arch varies from six to eight lines.

The sides of the gland are convex, and in relation with the elevator muscle of the anus, from which they are separated by a layer of the pelvic aponeurosis. The apex, directed downwards and forwards, is truncated, and terminates at the membranous portion of the urethra; it is in contact with Wilson's muscles, and is less than half an inch from the deep perineal fascia. The base, which is nearly horizontal, embraces the neck of the bladder, and is in apposition with the seminal vesicles and the deferential tubes. Near its centre, on each side of the middle line, is the entrance of the ejaculatory ducts, the direction of which is obliquely forwards and inwards through the substance of the gland.

A correct knowledge of the *natural dimensions* of the prostate, in the different periods of life, is of the greatest importance in relation to the operation of lithotomy and the proper appreciation of its own diseases. We find, accordingly, that the subject has received considerable attention from different observers. Among those who have contributed most to its elucidation, Deschamps occupies a pre-eminent rank. The proportions assigned by this celebrated lithotomist approach, perhaps, as near the truth as it is possible to attain. From numerous measurements, the general results of which are recorded in his *Traité Historique et Dogmatique de la Taille*, he concludes that the size of the prostate varies not only in the different periods of life, but also in different individuals of the same age. He has arranged his observations under the following heads.

1. In subjects from three to eight years of age, the thickness of the gland, measured anteriorly, is one line and three-quarters; posteriorly, two lines and a half; laterally, three lines and a half. When the prostate and neck of the bladder are laid open anteriorly in their whole length, spread out, and left to themselves, without being stretched, the neck at the vesical uvula is from eight to ten lines in

breadth, and consequently very nearly three lines in diameter. About a quarter of an inch above the lacuna of Morgagni, it is from six to eight lines; on a level with the lacuna, from four to six lines; and at the apex of the prostate, from three to four, four and a half, and even five lines. The length of the neck is from nine to ten lines.

2. In subjects from eight to sixteen years, the thickness of the anterior part is two lines; of the posterior, three lines; of the lateral, from four to five lines. When the prostate is laid open, its breadth at the vesical uvula is found to be from ten to thirteen lines, or very nearly four lines and a third in diameter. Three lines above the lacuna, the breadth is from eight to ten lines; on a level with the lacuna, from six to eight lines; and at the apex of the gland, from four to six, and sometimes even seven lines. The length of the neck is from eleven to twelve lines.

3. In subjects from sixteen to forty years of age, the thickness of the prostate, in front, is two lines and a half; behind, three lines; and at the sides, eight lines, frequently, indeed, nine, and sometimes even nine lines and a half. Laid open, the gland is fifteen lines broad at the vesical uvula, twelve lines at a quarter of an inch above the lacuna of Morgagni, and eight lines at the apex of the organ. The length of the neck of the bladder is from thirteen to fifteen lines.

Finally, in advanced life, these dimensions augment two and even three lines, except the thickness of the anterior and posterior extremities of the gland, which Deschamps has never known greatly to exceed the above measurements.

The following table is copied from Malgaigne's *Traité Anatomie Chirurgicale*,¹ and is founded upon upwards of forty cases in which this organ was measured by Mr. H. Bell. The subjects were from two to fifteen years, and the results are arranged under four categories, according to their ages.

Ages.	Transverse diameter.	Posterior oblique radius.	Posterior direct radius.	Anterior direct radius.
2 to 4 years	5½ to 6 lines	2 to 2½ lines	1 line	½ line
5 to 10 "	6 to 7½ "	2½ to 3 "	2 to 2½ lines	½ "
10 to 12 "	7 to 8½ "	2½ to 3½ "	2 to 2½ "	1 to 1½ "
12 to 16 "	8½ to 10 "	3½ "	1 to 2½ "	1½ "

Dupuytren² states the breadth of the prostate, measured at its base, in the adult, at from twenty to twenty-four lines, and its depth,

¹ Brussels Edition, p. 372, 1838.

² Mémoire sur L'Opération de la Pierre, p. 21. Paris, 1836.

which is a little greater at the sides than at the mesian plane, at from ten to twelve lines. Senn,¹ on the contrary, found the gland, in the adult, only nineteen lines in width at the centre of its transverse diameter, and only thirteen lines in its vertical direction along the middle line. Radii diverging from the urethra to the circumference of the organ, measure, towards its inferior and middle part, from seven to eight lines, directly outwards, nine lines, and towards the inferior and external part, from ten to eleven lines.

In six examinations of the healthy adult gland, made some years ago, I found the average length to be twenty-one lines, the width eighteen lines, and the thickness nine lines. In a well-developed subject, about twenty years of age, and five feet seven and a half inches in height, whose genito-urinary apparatus I dissected with great care, the prostate presented the following dimensions: length of each lateral lobe, from one extremity to the other, one inch and three-quarters; breadth at the widest part, which was about five lines in front of the seminal vesicles, one inch and five-eighths; breadth anteriorly, half an inch; and greatest thickness, which was at the centre of the body, five-eighths of an inch.

The dimensions assigned to this body by Dupuytren, are evidently somewhat exaggerated; they differ, at all events, considerably from those obtained by the measurements of Deschamps, Senn, and myself.

In the adult, I have found the medium weight of the healthy prostate, in six subjects, to be about five drachms. In a case which I recently examined, and the dimensions of which are given above, the weight was only three drachms. Sharpey and Quain² fix the weight at about six drachms, which is probably too high. I am not aware that any examinations have been made to ascertain the weight of the prostate in early life.

The annexed engravings exhibit the size and form of the prostate gland in seven subjects of different ages. The drawings from which they are copied were executed by Mr. Daniels, under my immediate inspection, and their accuracy may therefore be fully relied upon.³

The *color* of the prostate is influenced by age and other circumstances. In infancy it is of a reddish tint, not unlike that of the

¹ Malgaigne, *op. cit.* p. 365.

² Human Anatomy, ii. p. 526. Phila. 1849.

³ For opportunities of examining this gland in subjects of different ages, I am indebted, to some extent, to the kindness of different friends, particularly to Dr. Darling, the Demonstrator of Anatomy in the University of New York, Dr. Kelley and Dr. S. Rogers, of Blackwell's Island, and Dr. Moore, of the Bellevue Hospital.

thyroid gland; in childhood, it is of a lightish brown; in the adult, it is grayish, or nearly so; and in old subjects, it is generally of a dull drab color. Habitual engorgement has a tendency to heighten its complexion. A section of it, especially in advanced life, frequently exhibits a striated appearance.

Fig. 10.



Fig. 11.



Fig. 12.



Fig. 13.



Fig. 10. Prostate at birth. Width, at base, 4 lines; a little above middle, 5 lines; at apex, 3 lines; length along the middle, 4 lines, and at the edge, $4\frac{1}{2}$; thickness at base, 2 lines; at middle, $3\frac{1}{2}$, and at apex, $1\frac{1}{2}$. Weight, 13 grains.

Fig. 11. Prostate at 4 years. Breadth at base, 6 lines; just above the middle, 7; and at the apex, $2\frac{1}{2}$; length along the middle, 6 lines; and 7 lines at the margin; thickness at base, $2\frac{1}{2}$ lines; at the middle, 4; and at apex, 2. Weight, 23 grains.

Fig. 12. Prostate at 12 years. Width, $8\frac{1}{2}$ lines, at base; $9\frac{1}{2}$ above the middle, and 3 at apex; length along the middle, 8 lines, and $8\frac{1}{2}$ at the edge; thickness at base, 3; middle, $4\frac{1}{2}$; and at apex, $2\frac{1}{2}$. Weight, 43 grains.

Fig. 13. Prostate at 14 years. Width at base, 11 lines; at middle, $9\frac{1}{2}$; at apex, 4; length along the middle, 8 lines, and 10 at margin; thickness, $3\frac{1}{2}$ at base, 5 at middle, and 3 at apex. Weight, 68 grains.

Fig. 14.

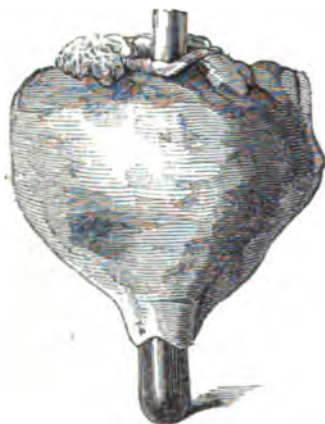


Fig. 15.

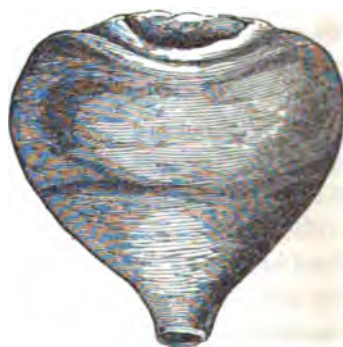


Fig. 14. Prostate at 20 years. Breadth at base, 14 lines; at middle, 16; at apex, $5\frac{1}{2}$; length along middle, 15 lines, and at edge, 16; thickness at base, 8 lines; middle, 10; and apex, $5\frac{1}{2}$. Weight, 4 drachms and 1 scruple.

Fig. 15. Prostate at 25 years. Width at base, 18 lines; middle, 20; and apex, 5; length along middle, 15 lines; and at edge, 18; thickness at base, 9 lines; middle, 10; at apex, 4. Weight, $4\frac{1}{2}$ drachms.

In its *consistence*, the prostate bears a more close resemblance to the thyroid gland than to any other organ in the body. It is tough

and fleshy in its feel, compressible, almost inelastic, and not easily torn, unless it has been previously incised, when it yields without

Fig. 16.



Fig. 16. Prostate at 52, man tall and stout. Breadth at base, 12 lines; just above middle, 18; at apex, 5; length along middle, 15; and at edge, 18; thickness at base, 5 lines; middle, 8; and at apex, 4. Weight, 3½ drachmas.

difficulty to the finger. Of the truth of this fact I have had ample evidence, both in the dead and in the living subject. In the operation of lithotomy, my common practice is to dilate the wound of the prostate with the finger; a proceeding which I have always found sufficiently easy. In old age, the consistence of the gland is much more firm than in early life, and nearly approaches that of the virgin uterus. The apex of the organ is, at all times, in health, the most resisting part.

Two lobes, united behind by a small delicate tubercle, compose this body; they are of an ovoidal shape, convex in front, slightly compressed behind, and narrower below than above, where they diverge from each other. These lobes are of equal dimensions in the healthy state, and their long axis is directed from before backwards. In the sulcus between them, exactly in the middle line, and consequently but a short distance from the mouth of the urethra, is a small body, now generally known as the middle, intermediate, or third lobe of the prostate. It is of a rounded form, and of variable dimensions; it rarely exceeds the volume of a pea, and is sometimes so small that it can hardly be said to exist. Indeed, the most careful dissection occasionally fails to detect it. Covered by the mucous and muscular coats of the bladder, it projects nearly on a level with the base of the lateral portions, which it closely resembles in its color, structure, and consistence. In order to see this body to the best advantage, it is necessary to raise the seminal vesicles and the deferen-

tial ducts from their connections, and to draw them forwards over the posterior surface of the gland, as in Fig. 17. Although the name of Sir Everard Home is usually associated with the middle lobe, yet he cannot be justly regarded as its discoverer; for both Morgagni and Hunter were aware of its existence in the natural state, and of its liability to chronic enlargement. Considering its diminutive size, the term lobule would be a more appropriate name for this body than that of lobe. Morgagni has described it under the name of caruncle; some have called it the tubercle of the prostate, and others the isthmus.

Fig. 17.



Fig. 18.



Fig. 17. Posterior view of the bladder and prostate, with the third lobe, the seminal vesicles and ducts being drawn forwards. a. Ureter. b. Bladder. c. Third lobe. d. Ejaculatory ducts, turned forwards. e. Seminal vesicle. f. Deferent duct.

Fig. 18. Follicles of the prostate, in a magnified state.

The gland is invested by an appropriate capsule, of a grayish color, which is continuous, on the one hand, with the vesical aponeurosis, and, on the other, with the posterior lamella of the deep perineal ligament. It is a dense, fibrous structure, and is evidently composed of two layers, inclosing between them the prostatic plexus of veins. The inner lamella, the more delicate of the two, is closely adherent to the outer surface of the organ, so that it is with great

difficulty separated from it, and sends numerous processes into its parenchymatous substance, intersecting it in every possible direction. The whole investment is deserving of particular attention in relation to the operation of lithotomy, as much of the mischief resulting from its division is often attributable to the infiltration of urinary and other fluids between it and the contiguous surface of the gland.

When divested of its proper covering, the gland will be found to be of a soft fleshy consistence, and to be composed of an assemblage of mucous follicles, Fig. 18, intimately united with each other, and filled with a thin, milky, and slightly viscid fluid. The size of the follicles varies; some are visible to the naked eye, and others are so minute as to require the aid of the microscope to detect them. According to Mr. Quekett, of London, who has recently examined them with much attention, their average diameter is about the one-hundredth part of an inch. They are connected together by an intermediate fibrous tissue, derived probably from the external investment of the gland, but they have no communication with each other. Leading from these follicles are minute tubes, which unite together to form the proper excretory ducts of the prostate. Of these, the diameter of which ranges from the sixth to the fourth of a line, there are usually from ten to fifteen, which pass forwards through the parenchymatous substance, and finally open upon the floor of the urethra around the gallinaginous crest, in the form of a horseshoe. These ducts and their terminal cells may be satisfactorily demonstrated by inflating them with air, or filling them with colored size.

The prostate is remarkably vascular. It is supplied by branches of the vesical, hemorrhoidal, and pudic arteries, which enter it in every direction, and form a delicate network upon the walls of its follicles and excretory ducts. Its veins, which are known under the name of the *prostatic plexus*, lie between the lamellæ of its fibrous capsule, and are liable, from the effects of age and disease, to great enlargement. Hence, when divided, as they always are in the lateral operation of lithotomy, they sometimes furnish a smart hemorrhage. They communicate in front with the dorsal vein of the penis, and behind with some of the branches of the external iliac vein. The lymphatics follow the same course as the veins. The nerves are derived from the hypogastric plexus.

CHAPTER IV.

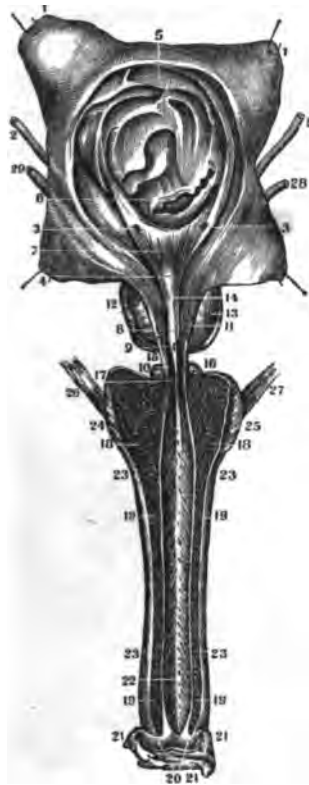
ANATOMY OF THE URETHRA.

THE urethra, Fig. 19, extends from the neck of the bladder to the anterior extremity of the penis, and serves the twofold purpose of an outlet to the urine and the semen. In its passage from behind forwards, it perforates the triangular ligament of the perineum, and then runs along the groove on the under surface of the penis, enveloped by a layer of spongy, erectile tissue. The length of the tube has been variously estimated by different writers; but may be stated, on an average, to be about nine inches, the maximum being twelve, and the minimum seven inches. Its diameter also varies in different regions of its extent, being about four lines and a half at the widest part, and from two and a half to three, at the narrowest. Attempts have been made by anatomists to reduce the dimensions of the urethra to some general standard by actual measurement, the canal having been previously distended with wax or plaster of Paris, to serve as a model. The proceeding, however, if not positively absurd, is practically of no benefit. Every surgeon knows that the length and diameter of the tube are not alike in any two individuals, any more than the feet or hands; and hence it would be just as ridiculous in him to expect to establish a standard in this respect as it would be for the boot or glovemaking. Every case must be considered by itself; for an instrument that will suit one will not suit another. In a word, to the practical surgeon it does not matter whether the urethra is five inches or ten inches in length; whether it is two lines or five lines in width. Every case is peculiar, and requires a peculiar instrument. I have occasionally passed, with perfect ease, a catheter nearly five lines in diameter; and, on the other hand, I have experienced great difficulty in introducing one of half that size.

It may be stated, as a general rule, that the *dimensions* of the urethra are not influenced by the size of the penis. Thus, we not unfrequently see men with a large organ having a small urethra, and, conversely, with a small penis and a capacious excretory tube. The narrowest part of the canal is at the external orifice, or a few

lines behind it; this is also the most dense, and, consequently, the least extensible part; while every other portion may, without any detriment or danger of laceration, be stretched to nearly twice the

Fig. 19.



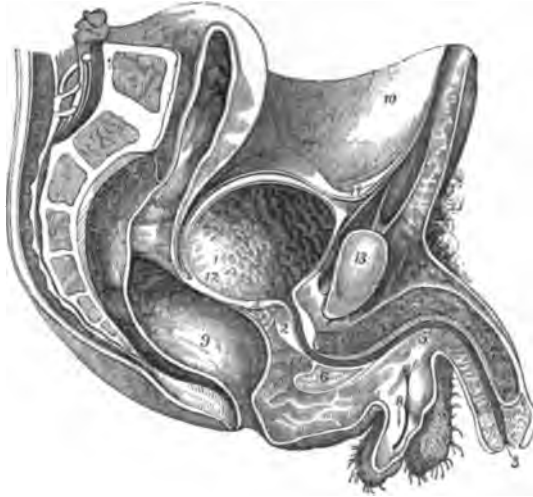
Internal view of the bladder and urethra. 1, 1. The bladder; cut open by a crucial incision, and the four flaps separated. 2. The ureters. 3. Vesical orifices of the ureters. 4. Uvula of the bladder. 5. Superior fundus of the bladder. 6. Bas-fund of the bladder. 7. The smooth centre of the vesical triangle. 8. The gallinaginous crest. 9. Orifice of the ejaculatory duct. 10. Sinus near the urethral crest. 11. Ducts of the prostate. 12, 13. Lateral lobes of the prostate. 14. Prostatic portion of the urethra; just above is the neck of the bladder. 15. Membranous portion. 16. One of Cowper's glands. 17. Orifices of the excretory ducts of Cowper's glands. 18. Section of the bulb of the urethra. 19. Cavernous bodies. 20. Gland of the penis. 21. Prepuce, dissected off. 22. Internal surface of the urethra, exhibiting its mucous lacunae. 23. Outer surface of the cavernous bodies. 24, 25. Accelerator muscles. 26, 27. Erector muscles.

natural size. Another narrow point exists at the commencement of the membranous portion, behind and in front of which, as far as the head of the penis, the tube has its greatest dimensions, and readily admits an instrument that will pass with difficulty along the other

regions of the canal. The prostatic portion is, in the natural condition, the widest part of the urethra.

The *direction* of the urethra (Fig. 20) is materially influenced by the position of the penis, and the condition of the bladder and rectum. When both these viscera are distended, and the member hangs flaccidly over the scrotum, the canal will be found to form three curvatures, in their shape not unlike the Italian \sim ; if, on the contrary, the organ is raised towards the abdomen, the bladder and the rectum being at the same time empty, there will be only a single bend, and that but very slight, the concavity of which is directed upwards. Now, by holding the penis at an angle of about sixty

Fig. 20.



Antero-posterior section of the pelvis of a male, exhibiting the viscera in their natural situation, and the curvatures of the urethra. 1. The bladder. 2. The prostate. 3, 3. The urethra, laid open through its whole extent. 4. The seminal vesicle, laid open. 5. The bulb of the spongy body. 6. The spongy body, seen both above and below the urethra. 7. The cavernous body of the penis. 8. The right side of the scrotum. 9. The rectum. 10. The peritoneal lining of the abdominal muscles. 11. The peritoneal investment of the bladder. 12. The point where the peritoneum is reflected from the bladder upon the rectum. 13. The section of the pubic symphysis. 14. A line marking the situation of the triangular ligament.

degrees with the trunk, and pressing it down from its pubic attachments towards the perineum, the three curvatures here spoken of will be almost completely effaced, and so the tube brought nearly into a straight line, with a slight inclination forwards and upwards. This fact, which is of great interest in reference to the introduction of the straight catheter, appears to have been familiar to some of the

ancient anatomists, but for a revival of it in the present day we are indebted mainly to some of the French investigators, particularly to Montagu, Amussat, and Leroy.

The urethra may be divided, for practical purposes, into four portions, differing from each other in their extent, and in regard to the parts by which they are invested. These portions are the prostatic, membranous, bulbous, and spongy.

1. The *prostatic portion* (Fig. 21, 9, 9) begins at the neck of the

Fig. 21.



This cut exhibits the bulbous, membranous, and prostatic portions of the urethra, with part of the bladder. 1. Inner surface of the bladder. 2. Vesical trigone. 3. The orifices of the ureters. 4. Uvula of the bladder. 5. The gallinaginous crest. 6. The opening of the prostatic sinus. 7, 7. The orifices of the ejaculatory ducts. 8, 8. The apertures of the ducts of the prostate. The numbers 7, 7, and 8, 8, are placed on the cut surface of the supra-urethral portion of the prostate gland. 9, 9. The lateral lobes of the prostate. a. The membranous portion of the urethra. b, b. Cowper's glands. c, c. The apertures of the excretory ducts of Cowper's glands. d. The commencement of the bulbous portion of the urethra. e, e. The upper surface of the bulb. f, f. The legs of the penis. g, g. The cavernous bodies. A. The spongy portion of the urethra.

bladder, and extends forwards a distance of from twelve to eighteen lines, according to the age and stature of the subject. It derives its name from the fact that it runs through the substance of the prostate gland. The relations of this portion of the canal with this body vary in different individuals, and deserve to be carefully considered on account of their surgical importance. In most of my examinations I have found the urethra situated towards the superior part of the prostate, in a sort of gutter, covered merely by a thin layer of parenchymatous substance. Sometimes the tube runs through the

centre of the gland, which thus forms a kind of hollow cylinder for it. Occasionally, again, though very rarely, the urethra occupies the inferior part of this organ, the greater volume, by far, lying upon its upper surface. When this arrangement obtains, the canal and the rectum approach each other much nearer than usual, in consequence of which the latter is in danger of being wounded in the operation for stone.

In its natural state, the prostatic portion is the widest part of the canal. In its shape, it is somewhat conical, the apex of the cone being directed forwards, and the base backwards. It is situated within the pelvic cavity, and is attached to the branches of the pubic bones by the anterior ligaments of the bladder; its direction, in the erect position of the body, being obliquely downwards and forwards. This is the case in the adult; but in the aged subject it is dragged down by the bas-fond of the bladder, and is, consequently, more horizontal. In childhood, when this viscus is, in great degree, lodged in the abdomen, the prostatic portion of the urethra is nearly vertical. These facts are important in relation to lithotomy.

In the middle of the floor of the prostatic portion of the tube is a narrow, oblong, prominent ridge, which, from its fancied resemblance to the comb of the woodcock, has received the name of the *gallinaginous head*; it is also called the *verumontanum*, and the *urethral crest*. It is formed by a duplicature of the lining membrane, inclosing a small quantity of dense cellular tissue, and varies in length from nine to twelve lines; it has a narrow rounded point in front, and a sort of bulbous expansion behind, near the neck of the bladder, where it terminates. In the centre of the crest is a small cul-de-sac, formed by the orifice of a large mucous follicle; and on each side in front is the mouth of the ejaculatory duct. Just behind the duct, in a longitudinal gutter, named the *prostatic sinus*, are the little openings of the excretory canals of the prostate gland, from eight to twelve in number, and so delicate as hardly to admit an ordinary-sized bristle. The sinus terminates posteriorly in a blind pouch, which merits special attention, as it is sometimes apt, especially when it is enlarged, to arrest the beak of the catheter when an attempt is being made to pass it into the bladder.

2. The *membranous portion* (Fig. 21, *a*) extends from the apex of the prostate gland to the bulb, and obtains its name from a consideration of its structure. It is also sometimes called the *muscular portion*, from the fact that it is surrounded by muscular fibres. It is the shortest and narrowest part of the canal, its length being

usually not more than ten or twelve lines, and its diameter not more than three and a half or four. Its direction is nearly horizontal, though, in general, it is described as forming a slight curvature with the concavity looking upwards. Situated nearly one inch beneath the pubic symphysis, it passes through the opening in the deep perineal fascia, and unites with the bulb immediately behind the junction of the two cavernous bodies of the penis, its entrance being from above downwards, sometimes several lines from the inferior extremity of the latter division of the canal. The membranous portion is composed entirely of the proper tunics of the urethra; it is supported, however, by a pair of small muscles, known as the muscles of Wilson, and is strengthened by a tubular prolongation of the deep perineal fascia, one process of which extends forwards, and is insensibly lost upon the bulb, while the other passes backwards, and becomes continuous with the fibrous investment of the prostate gland. Additional muscular fibres are sometimes found in contact with this division of the canal, which they surround in the form of a sling, and which, by their contraction, may oppose a serious obstacle to the introduction of the catheter. From having been first noticed and described by Mr. Guthrie, of London, they are usually called by his name.

3. The *bulbous portion* (Fig. 21, *d*) is about an inch in length, and may be regarded as being intermediate in size between the spongy and prostatic divisions, though at first sight it would seem to be much more capacious than any other portion of the tube. Occupying the greater part of the space which exists beneath the legs of the penis, it is directed obliquely upwards and forwards, and is surrounded by the fibres of the accelerator muscle, the irregular, spasmodic action of which must often exert no little influence upon its caliber. It is continuous insensibly in front with the spongy portion, and is invested by a large quantity of erectile tissue, which abounds chiefly upon its inferior surface. Internally, it receives the orifices of the ducts of Cowper's glands, two small, reddish bodies, interposed between the layers of the triangular ligament of the perineum; and presents a remarkable dilatation, chiefly upon its inferior surface, called the *sinus of the bulb*. As this depression forms a considerable angle with the membranous portion of the canal, it constitutes one of the principal obstacles to the introduction of the catheter, and is therefore deserving of particular study. The manner of overcoming this impediment will be pointed out elsewhere. The bulb of the urethra receives a large branch from the internal pudic artery, and

is liable to copious hemorrhage when there is a wound or rupture of the lining membrane.

4. The *spongy portion* (Fig. 21, *h*) is from four and a half to six inches in length, and is invested in the whole of its extent by a thin layer of spongy erectile tissue; whence its name. It is lodged in a groove on the under surface of the penis, at the anterior extremity of which it terminates in a narrow slit-like orifice. Its diameter, which is from three to four lines, continues nearly of the same uniform size from its commencement until it reaches the head of the penis, where it dilates into what is called the *navicular fossa*. This expansion is supposed by some of the French anatomists to be rather apparent than real; an opinion for which there is no just foundation, for I am satisfied, from repeated examinations, that it is always present in the normal state of the parts. The external orifice, technically called the *urinary meatus*, is the narrowest, as well as the least dilatable, part of the canal, and often opposes no little resistance to the introduction of a large sound or bougie. It derives its distinctive characters from the presence of a layer of firm cellulo-fibrous tissue, placed immediately beneath the mucous lining.

The urethra is composed of two membranes, the inner of which, mucous in its character, is continuous, on the one hand, with the smooth covering of the head of the penis, and, on the other, with the mucous lining of the bladder. Two delicate, whitish, longitudinal ridges are observable upon the inner surface of this coat, corresponding with the middle line of the penis, and the inferior one of which terminates behind in the gallinaginous crest. Besides these, there are other folds, especially in the membranous and spongy portions, less distinctly marked than the preceding, and generally easily effaced by distension. Between the bulb and the external meatus a great number of small openings exist, giving the surface of the tube a sort of cribriform appearance; they are all directed forwards, and are merely the orifices of so many mucous follicles, placed exterior to the inner coat, but lined each by a delicate process prolonged from it into its interior. If bristles be introduced into these ducts, they may, in many cases, be carried backwards from three to six lines into the submucous tissue in which the crypts are lodged. They are most abundant upon the inferior surface of the tube, and are all quite small in the normal state, except one at the bottom of the navicular fossa, which, from its large size, has received the name of the *great sinus*. These passages constantly discharge a thin, mucous fluid for lubricating the lining membrane, and in certain

states of disease, as in gonorrhoea and stricture, they occasionally acquire such a bulk as to entangle the point of the bougie or catheter.

The outer coat of the urethra is a thin lamella of cellular tissue, which serves to connect the tube to the circumjacent textures. It is of an erectile spongy character, and is pervaded by a great number of minute vessels, which impart to it a singularly striated aspect, not unlike fleshy fibres. This reddish vascular appearance, added to the contractile power of the urethra, induced Mr. John Hunter, and afterwards Sir Everard Home, to believe that this tunic was essentially muscular in its nature. The opinion of the former of these writers rests wholly on assumptions, deduced from pathological facts and reasonings; that of the latter is founded upon minute microscopical inspections. From these it would appear that the external membrane of the urethra is made up of short longitudinal fibres, variously interwoven with each other, and united together by a soft elastic substance. How far these results are worthy of confidence, is a point not easily determined. The question is still open, notwithstanding the numerous attempts that have been made to settle it. That the substance under consideration is really muscular is altogether improbable, though there are few practical surgeons who will deny its contractile power in certain states of the urethra.

Since the publication of the first edition of this work, the minute structure of the urethra has been examined by a number of microscopists, especially by Professor Kölliker,¹ of Würzburg, and Mr. Henry Hancock,² of London. From the researches of these gentlemen it would appear that the urethra is not only muscular, but eminently muscular, throughout its entire extent, from the neck of the bladder, where this substance is continuous with the muscular fibres of that organ, to the extremity of the tube, where it forms a sort of sphincter. The account of the English observer is accompanied by several beautiful illustrative engravings, and as it is more recent, as well as more minute, than that of the German anatomist, I shall give it at length in his own language.

"The organic muscular fibres in the prostate gland, connected with the urethra, are continuous with those of the internal muscular coat of the bladder, whence they may be traced, by careful examina-

¹ *Manual of Human Microscopic Anatomy*, edited by J. Da Costa, M. D., p. 681. Phila. 1854.

² *On the Anatomy and Physiology of the Male Urethra*, p. 12. London, 1852.

tion, passing forwards through the prostate gland. These fibres, destined to invest the membranous and other portions of the urethra, appear to me to be entirely distinct from the organic muscular fibres found in large quantities throughout the gland, particularly around the sinus pocularis in the verumontanum, or caput gallinaginis, where the principal excretory ducts of the gland, with the common ejaculatory ducts, open. Organic muscular fibres surround the various ducts which permeate the gland in all directions, and may, in the instance of the common ejaculatory ducts, be traced into the gland from the vas deferens, where they may readily be seen.

"The same arrangement obtains around the proper excretory ducts of the gland, and is beautifully shown where calculi are present in any quantity or size, in which case the foreign body may be seen impacted in the duct or cell, with a circle of these organic fibres surrounding it.

"The muscular fibres of the prostate are best seen in the prostate of a foetus of between six and nine months, at which age the muscular fibres are very distinct, having large nuclei. In old age, the muscular fibres, though readily traced, are not so distinct, owing to the phosphatic deposits and fatty degeneration which take place in the prostate gland at that period of life.

"The organic muscular fibres found generally throughout the prostate gland, belong in a great measure, I believe, to the numerous vessels and ducts which ramify so freely through this body, as Mr. Guthrie has pointed out; but these general fibres are, as I have before observed, distinct from those derived from the inner layer of the muscular coat of the bladder, and which form a layer surrounding the prostatic portion of the urethra, separated from it merely by elastic and non-elastic areolar tissue. Kölliker says these fibres for the most part have no connection with the muscles of the bladder. The outer layer of the muscular coat of the bladder, on the contrary, passes forwards on the outside of the prostate gland, and laterally and inferiorly joins the fibres derived from the inner coat in front of the prostate gland, to assist in forming the organic muscular covering of the membranous portion of the urethra. Whilst, superiorly, or on the upper surface of the gland, the external longitudinal fibres are arranged in two or more bundles, which are attached, as Mr. Guthrie pointed out in the year 1830, to the pubes near its symphysis. From the front of the prostate the conjoined layer of organic fibres passes forwards to the bulb, investing the membranous portion of the urethra, covered by, but distinct from, the common

muscles of the part, the latter being inorganic, voluntary, or striated; these being organic and nucleated. Arrived, however, at the bulb, these two layers again part company, and extend forwards through the whole length of the spongy portion of the urethra, the internal layer running between the corpus spongiosum itself and the urethra, but separated from the latter by areolar tissue; the external lying on the outside of the corpus spongiosum, separating the proper spongy tissue from its fibrous investment. Upon reaching the anterior extremity of the urethra, these two layers again unite, and form a circular body or band of organic muscular fibres, constituting that peculiar structure usually denominated 'the lips of the urethra,' and which had previously been considered by Mr. Guthrie as surrounded by a peculiar dense structure, analogous to that which forms the edge of the eyelid, and which he believed was requisite to maintain the patency of the opening: so that not only have we the urethra supplied by a coat of organic or involuntary muscular fibre, but the spongy body itself lies between its two layers of involuntary muscle, an arrangement, doubtless, of very great importance in relation to the due performance of the functions of the part. And, as regards the urethra, this arrangement holds good wherever we find the spongy tissue, whether the quantity of that tissue be small or great; for, at the glans, which is formed not only by increased development, but also by a folding back, as it were, of the corpus spongiosum upon the corpora cavernosa, we have these muscular layers multiplied; whilst, on the upper surface of the urethra, where there is merely a narrow portion of corpus spongiosum, the same arrangement holds good. Independent of these layers of organic muscular tissue, nucleated fibres may be found distributed occasionally throughout the spongy tissue, but I think they belong more properly to the arteries of the part."

CHAPTER V.¹

NATURE AND COMPOSITION OF THE URINE.

THERE is no fluid, which, even within the limits of health, is liable to so many variations in its physical and chemical properties as the urine. Its quantity, also, is extremely uncertain, as it is influenced by numerous circumstances, especially by the state of the skin and the amount of liquids received into the stomach. On an average, however, a healthy person voids about forty ounces in the twenty-four hours. From this it may range from twenty ounces, as the minimum, to fifty ounces, as the maximum. When perfectly normal, the urine is of a pale amber color, transparent, or nearly so, saline in its taste, and slightly aromatic in its odor. Its specific gravity varies greatly in health, and is always in an inverse ratio to its quantity. The average, throughout the twenty-four hours, is about 1.020. The fluid is always acid in health, and hence it readily imparts a red tint to litmus paper. It deposits, on standing, a minute quantity of opaque mucus, in combination with a few epithelial scales. It does not, as was once supposed, contain any super-salts of lime. Its acid property is probably due to the presence of acid salts.

The quantity of solid matter that passes off by this excretion, daily, varies according to its specific gravity. It is, on an average, about two ounces, its minimum being half an ounce less, and the maximum half an ounce more.

¹ The present chapter, which was originally transferred from my *Elements of Pathological Anatomy*, has been thoroughly revised and much enlarged. The rules for examining the urine have been composed with the aid of Mr. Thomas E. Jenkins, the assistant of the Professor of Chemistry in the University of Louisville. Our literature upon this subject has been greatly enriched within the last few years. Besides the *Treatise* of the late Mr. Prout, for a long time the only one of the kind in the English language, we have now the excellent manuals of Bird, Marwick, Rees, Griffith, and Willis, and the *Practical Hand-book of Medical Chemistry* by Mr. John E. Bowman, which contains a succinct but excellent outline of the chemistry of the urine and of urinary deposits. Very recently, a small but valuable work on the urine was published by Dr. Charles Frick, of Baltimore, who is well known for his labors in this department of pathology and practice. It should be in the library of every American physician.

Three varieties of urine, differing materially in their physical and chemical properties, are recognized by modern observers. These are respectively denominated potous, chylous, and sanguineous. The first is that passed a short time after the free use of fluids, and is generally of a pale color; it is of low specific gravity, rarely exceeding 1.009, and contains comparatively little solid matter. In chylous urine, the product of the digestion of a full meal, the specific gravity is generally considerably increased, and may be said to range between 1.020 and 1.030, the latter of which, however, it rarely attains. The sanguineous urine, the urine of the blood, or the morning urine, is the most elaborate variety of the three. It is of the average density of 1.015 to 1.025, and exhibits in perfection all the essential properties of this important fluid.

One of the most elaborate and accurate analyses of this fluid is by Berzelius. According to this distinguished chemist, 1000 parts of urine are composed of:—

Water	.	.	.	.	.	.	983.00
Urea	.	.	.	.	.	.	80.10
Uric acid	.	.	.	.	.	.	1.00
Sulphate of potash	.	.	.	.	.	.	3.71
Sulphate of soda	.	.	.	.	.	.	3.16
Phosphate of soda	.	.	.	.	.	.	2.94
Phosphate of ammonia	.	.	.	.	.	.	1.65
Muriate of soda	.	.	.	.	.	.	4.45
Muriate of ammonia	.	.	.	.	.	.	1.50
Phosphate of lime and magnesia	.	.	.	.	.	.	1.00
Silicious earth	.	.	.	.	.	.	.03
Vesical mucus	.	.	.	.	.	.	.32
Free lactic acid, lactate of ammonia, and animal matter not separable from them	.	.	.	.	.	.	17.14

The following is the average of three analyses of this fluid by Lehmann. The results, it will be observed, do not differ materially from those of Berzelius:—

Water	.	.	.	.	.	.	984.567
Urea	.	.	.	.	.	.	82.424
Uric acid	.	.	.	.	.	.	1.064
Lactic acid	.	.	.	.	.	.	1.520
Lactates	.	.	.	.	.	.	1.565
Mucus	.	.	.	.	.	.	0.107
Alkaline sulphates	.	.	.	.	.	.	7.808
Phosphate of soda	.	.	.	.	.	.	3.806
Phosphates of lime and magnesia	.	.	.	.	.	.	1.142
Chlorides of soda and ammonia	.	.	.	.	.	.	8.653
Watery extract	.	.	.	.	.	.	0.614
Alcoholic extract	.	.	.	.	.	.	10.267

Besides these ingredients, the urine contains a small amount of sulphur, phosphorus, and a peculiar yellow coloring matter, which has not yet been obtained in a separate state. In the urine of infants there is also generally some benzoic acid.

Very recently, two other substances, *creatine* and *creatinine*, were discovered in the urine, as natural constituents of the renal secretion. Their existence had been detected, long ago, by M. Chevreul in the juices of flesh. Being highly nitrogenous, they are regarded by physiological chemists as excrementitious in their character, the latter being derived from the former, and both ultimately passing into urea. They exist in muscular tissue generally, the largest proportion being found in the heart, while they are entirely absent in the brain, liver, and kidneys. In the muscles, creatine predominates over the creatinine in quantity, the reverse being the case in the urine. The chemical as well as the physiological relations of these principles are very similar; for, the disengagement of two atoms of water transforms creatine into creatinine, thereby rendering strongly basic a substance which is chemically neutral.

Such, then, in a few words, are the characters of this excretion in the normal state of the system. But, as might be expected, this fluid undergoes great changes in various disorders of the body, which may be conveniently reduced, as has been suggested by Andral, to three classes. Under the first category are comprised those cases in which there is merely deficiency or excess of the natural constituents of the urine; in the second, there is an addition of new principles, analogous to those that are contained in the blood; and under the third head are embraced such substances as are deposited with the urine, but are not found in the circulating fluid, either in the healthy or diseased state. Each of these classes affords interesting topics of inquiry, which demand brief consideration in this place, referring for more ample details to the excellent treatises of Berzelius,¹ Prout,² and other writers.

1. *Water*, being naturally present in greatest abundance, is more liable to variation than any of the other constituents of the urine. In nervous diseases, especially such as are of an hysterical character, this secretion is generally unusually copious as well as remarkably thin and limpid, looking more like well-water than common urine. In diabetes insipidus, the urine, which is often discharged in immense

¹ *Traité de Chimie*, t. vii. Paris, 1838.

² *Inquiry into the Nature and Treatment of Gravel*, &c.

quantities, consists almost wholly of water; the urea is entirely absent; and the fluid, on evaporation, deposits a yellow-brownish syrup, in which there is no appearance of crystals, and which possesses a very feeble acid reaction.

Urea, next to water, exists more largely in healthy urine than any other ingredient. The quantity daily voided by a healthy adult man varies from four to seven drachms; in the female, child, and old man, it is considerably less. According to Lecanu, Rayer, and Guibourt, it is never present in the urine of infants at the breast. The quantity of urea, as might have been expected, has been found to be considerably influenced by different kinds of diet. Thus, M. Lehmann, in some experiments which he performed on himself, obtained from the urine which he passed during twenty-four hours, the following interesting results:—

	Grains.
After a non-nitrogenous diet	287.909
" a vegetable diet	847.061
" an animal diet	821.270
" a mixed diet	501.704

Urea presents itself in the form of four-sided, prismatic crystals, colorless, transparent, and of a pearly lustre (Fig. 22). It has a faint and peculiar odor, leaves a sense of coldness on the tongue similar to that of nitre, and evinces no acid or alkaline reaction when brought in contact with test-paper. It undergoes no particular change on exposure to the air, except in damp weather, when it slightly deliquesces, but is not decomposed. Its specific gravity is 1.35; it combines with acids, especially the nitric and the oxalic; and is soluble, in various degrees, in cold and hot water, and in cold and boiling alcohol.¹

Urea is furnished sparingly in certain diseases, as in chronic inflammation of the liver, in granular degeneration of the kidney, in dyspepsia, pulmonary phthisis, gout, and intermittent fevers. It has been supposed, but erroneously, to be wanting in diabetes mellitus. Both Barruel and Henry have shown that it is generally present, and they suppose that the error into which other chemists have fallen, in respect to this matter, has arisen from the tendency which the sugar has to prevent the nitrate of urea from crystallizing. Urea sometimes exists in excess. This state is usually combined with preternatural activity of the renal function, and can easily be recognized by mixing with the urine an equal quantity of nitric acid.

¹ Marwick's Guide to the Examination of the Urine, p. 22. Phila. 1848.

The existence of *lactic acid*, as a constituent of healthy urine, appears to be still undetermined. Berzelius, who first announced it, mentions it in his table, and other chemists have generally admitted it on his authority; but the recent researches of Liebig throw some doubt upon the subject, if they do not absolutely disprove the fact. Boussingault has shown that this acid is an ingredient of the urine of herbivorous animals, and he has also detected traces of it in the urine of a pig fed on potatoes.¹

Healthy urine has lately been found to contain a small quantity of *hippuric acid*, the existence of which had been long known as a constituent of the urine of graminivorous animals, especially the horse, whence the name. Its detection is always difficult and tedious, inasmuch as it never occurs in the form of a sediment until after the addition of a strong mineral acid. The urine which contains it, and which is either acid, neutral, or alkaline, should be evaporated almost to dryness, when about half its bulk of hydrochloric acid should be added. The presence of hippuric acid will be denoted by the appearance of a bright pink color, and the extrication of a peculiarly pungent hay-like odor. If the mixture be permitted to stand for some hours, and then dissolved in alcohol, characteristic crystals will be formed, having a dendritic and plumose outline, as in Fig. 22. A watery solution, on the contrary, will furnish minute needles, and

Fig. 22.

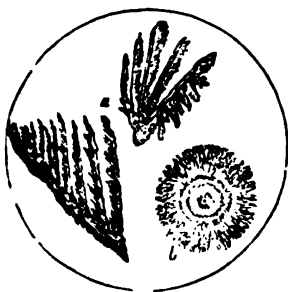
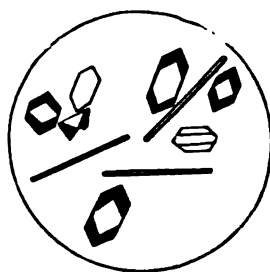


Fig. 23.



four-sided prisms, with sharp ends, as displayed in Fig. 23. Too little is known of this acid to enable us to judge of its value as a diagnostic in cases of disease. It has been found in various atonic and nervous complaints, and is generally associated with a deficiency of urea. When it exists in excess, it has been commonly traceable to a want of assimilative action, and the long-continued use of some

¹ Bird on Urinary Deposits, p. 93. Phila. 1854.

particular article of vegetable diet, productive of acidity and flatulence in the alimentary canal.

Uric acid, supposed by Dr. Prout never to be present in healthy urine, though enumerated by Berzelius and some other chemists as one of its ordinary ingredients, generally greatly predominates in arthritic affections, as is shown by the formation of the earthy concretions, which are so frequently seen in the joints of the extremities, and which seem to be composed principally of the urate of soda, with a small quantity of the urate of lime. Gravel commonly consists of uric acid, and it is well known that this substance forms the basis of one of the most common varieties of urinary calculi. In diabetes mellitus, this acid is entirely absent, no trace of it whatever being discoverable by the most delicate tests.

In some instances, this substance occurs in a free state; but most generally it appears in combination with an alkali; and, so long as this is the case, it does not yield a crystalline deposit. The undue secretion of this substance is usually produced by errors in diet, and by whatever has a tendency to impair the digestive powers. Hence it is most commonly met with in dyspeptic persons, of a gouty, irritable habit, in whom it sometimes prevails to a most serious extent.

A deficiency of *phosphoric acid* is not less injurious than an excess of uric. Prout supposes that, when this acid is not secreted in due proportion, the earthy materials of the urine are converted into neutral salts, and then precipitated, so as to afford an opportunity for the formation of a stone.

The *alkalies* which enter into the composition of this fluid are sometimes secreted in excess, and, by combining with the acid ingredients, may form salts, which, on being deposited in the bladder, give rise to calculous concretions. This is especially the case with the lime and ammonia, the soda and potash producing little or no inconvenience.

Urine always contains, even in the healthy state, a small quantity of *mucus*, which, however, as it is perfectly transparent, does not become visible until after the fluid has stood some time in a tall, narrow glass vessel. It then presents itself near the bottom of the receiver, as a light but distinct cloud, which contrasts very strikingly with the clear supernatant fluid. It is always more or less transparent when moist, is not coagulable by boiling water, is soluble in caustic potash, and forms, on the addition of acetic acid, a thin, semi-opaque, corrugated, and characteristic pellicle. When dried, it has a peculiar shining aspect. Under the microscope, it is observed

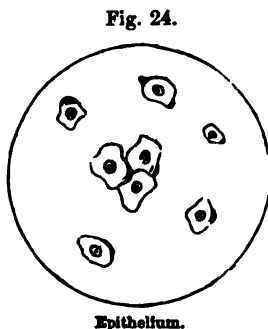
to have the same globular appearance as pus, but the particles are less numerous, and also less distinctly granular. They are suspended in a viscid, glairy fluid, sometimes combined with a minute trace of albumen. The urine with which the mucus is united is generally alkaline, and remarkably prone to decomposition, which not unfrequently takes place even in the bladder, especially if it be long retained. However this may be effected, whether in this organ, or subsequently to its expulsion, it always renders the fluid excessively offensive and disagreeable.

The quantity of mucus is frequently much increased in disease. In cystorrhœa, for example, it is so abundant as to impart to the affection its distinctive character. An augmentation of quantity is usually associated with an augmentation of consistence. In chronic cystitis, attended with a copious secretion of mucus, the fluid is generally exceedingly tough and viscid, adhering tenaciously to the bottom and sides of the receiver, and allowing itself to be drawn out in long, stringy threads. It is, also, under these circumstances, not unfrequently associated with phosphatic deposits.

The lining membrane of the genito-urinary apparatus, like the external surface of the skin, is constantly engaged in throwing off *epithelial cells*, of variable size, and of an oval, or irregularly angular and flattened configuration, each having a well-marked central nucleus; sometimes they are broken up, and arranged in scales, patches,

or lamellated plates. (Fig. 24.) They frequently occur in combination with oxalate of lime, and in certain affections, especially in Bright's disease, they contain fat-globules.

The quantity of epithelial matter is generally small, but it has been found to be so large as to produce a copious deposit in the urine, greatly resembling mucus, but easily distinguished from it by its peculiar microscopic characters, and the absence of viscid qualities.¹



2. The process of secretion, which is constantly going forward in the kidney, sometimes proceeds to a morbid extent in consequence of which substances are generated which do not naturally occur in the urine. The most important of these, in reference to the pathology and treatment of diseases, are albumen,

¹ Bird on Urinary Deposits, p. 288. Phil. 1854.

fibrin, the coloring matter of the blood and pus. Other substances are occasionally observed, which get into the urine accidentally, and impart to it their peculiar properties. Of this description are the yellow matter of the bile, asparagus, oil of turpentine, and most of the balsamic preparations. Cantu detected mercury in the urine of persons who had been subjected to frictions with that substance, in the form of ointment; and the ferrocyanide of potash, tartaric acid, iodine, quinine, and a hundred other articles have been observed by different chemists in this fluid, after they had been used as medicines.

In severe cases of jaundice, whether resulting from duodenitis, inflammation of the liver, or obstruction of the natural outlets of this organ, the *bile* passes from the blood into the kidneys, and communicates a yellow tint to the urine, at the same time that it renders it more acid. The most delicate test of its presence is nitric acid, which causes either a green or brownish hue, according to the peculiar modification of the coloring principle of the foreign ingredient. Linen and paper will receive a very distinct yellow stain, which remains when dried. The muriate of iron and the acetate of lead produce a yellow precipitate, the sulphate of copper, a dirty green one.

Albumen is said by some to be always contained in very minute quantity in healthy urine; but, however this may be, this substance is frequently present in certain diseases, in large proportion. In the granular affection of the kidney, so ably elucidated by Dr. Bright, albumen generally exists in considerable quantities, though it cannot be regarded as pathognomonic of that singular lesion, as it has been repeatedly observed in pneumonitis, dropsy of the abdomen, tubercles of the lungs, prurigo, and typhoid fever. Both Bouilland and Piorry declare that they have frequently noticed this substance in diseases which had no connection whatever with the urinary organs. According to Dr. Blackall, it is characteristic of certain kinds of dropsy, especially such as are accompanied with a phlogistic diathesis, an opinion which has been amply confirmed by the researches of other pathologists.

Albuminous urine is generally of low specific gravity, from deficiency of urea and salts, of a pale, opaline color, and readily coagulable on exposure to heat. The ferrocyanide of potassium, alum, and nitric acid will also curdle it.

The urine sometimes contains *fibrin*; probably, indeed, more frequently than is generally supposed. It appears to be occasionally

present when there is apparently no morbid action. Thus, Dr. Prout saw an instance in a middle-aged woman, who had a most voracious appetite, but was otherwise perfectly healthy. Her urine, which was of a pale yellow tint, was extremely thick, and contained a large quantity of matter, which bore the greatest resemblance to the fibrin of the blood. The appearance of this substance is occasionally associated with certain forms of dropsy; but how it is produced it is impossible, in the present state of our knowledge, to determine, as nothing is yet certainly known respecting it. In general, however, it depends, there is reason to believe, upon some structural disease of the kidney, or upon inflammation of the bladder, ureters, prostate gland, or urethra. In some cases of this kind there are large cells, from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in diameter, full of granules, and with or without a distinct nucleus. These appearances are well represented in Fig. 25.

Fig. 25.

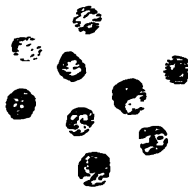


Fig. 26.



Casts of the *uriniferous tubes* are also sometimes present in the urine; generally in combination with pus-corpuscles, epithelium, blood-disks, or oil-globules. Their appearance is usually denotive of serious organic lesion of the renal tissues, especially when they are associated with fatty matter. The microscopic characters of these deposits are exhibited in the adjoining sketch (Fig. 26).

The urine not unfrequently contains pure *blood*. This may be owing to various causes, the most common of which are external violence, eventuating in a laceration of some of the vessels of the genito-urinary apparatus, the passage of a renal calculus, ulceration of the mucous surfaces, and the presence of encephaloid, fungous, or erectile tumors. Occasionally, though rarely, the fluid is the result of a process of exhalation. A discharge of blood from the urinary organs appears to be occasionally endemic. M. Chapotain

informs us that, in the Isle of France, young children are exceedingly prone to hæmaturia, without any particular suffering or derangement of the general health.¹

The quantity of blood may be so small as to be hardly visible, or so large as to give the urine a dark-red, claret, or blackish aspect. In the former case, the fluid deposits a reddish sediment, and will either be of a light pink, or dirty, dingy hue, according to the period that has elapsed since the occurrence of the effusion. When the quantity is very abundant, a considerable portion of it usually presents itself in the form of black, half-dissolved clots, or in that of short, cylindrical pieces nearly of the shape of leeches.

When the blood exists in large quantity, its presence is, in general, easily detected by the peculiar color which it imparts to the urine, by its tendency to subside to the bottom of the receiver, and by its alkaline properties. The readiest and most infallible mode, however, of discriminating between it and other substances is to examine it with the microscope. For this purpose, a minute portion of the suspected fluid is placed in a watch-glass in the field of the instrument. If it be of a bloody character, it will be found to contain a great number of corpuscles, which, although usually somewhat altered in shape, are yet sufficiently characteristic. When the blood is very recent, or has not been acted upon much by the urine, it generally retains its normal appearance, and is consequently more easily distinguished. Fig. 27 represents the blood-corpuscles in an aggregated, and Fig. 28 in a separate state.

Fig. 27.

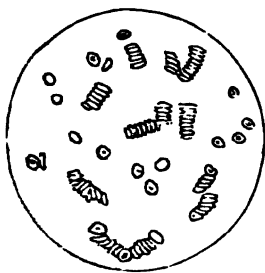
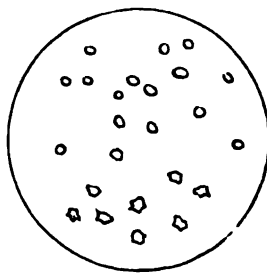


Fig. 28.



When blood exists in the urine in large quantity, it is commonly to be regarded as denotive of serious mischief in the genito-urinary apparatus. When it is mixed with pus, or mucus, or both,

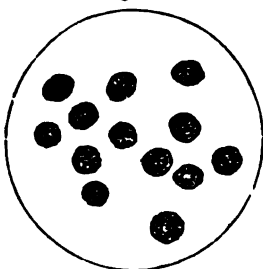
¹ *Topographie Méd. de Isle de France. Paris, 1812.*

and voided with pain, it indicates ulceration of the bladder, kidney, or prostate gland. When it is passed along with particles of soft jelly-like matter, it denotes the existence of encephaloid disease, or of fungus hæmatodes. Voided in a pure state, and in large quantity, without pain, it is probably merely an exudation from some portion of the mucous membrane of the genito-urinary apparatus.

Pus is a very frequent ingredient of urine, and is generally denotive of organic lesion of the genito-urinary apparatus. Its admixture may, however, be purely accidental, as when it is caused by the bursting of an abscess into the bladder, or the pelvis of the

kidney. It has also been supposed, though there is no positive evidence that such is the fact, to be occasionally vicarious of purulent deposits in remote parts, as the pleura and the lungs. The urine with which the pus is combined always contains albumen, is indisposed to putrefy, and is generally acid or neutral; when first voided, it is more or less turbid, but it soon assumes a pale appearance, though it never becomes perfectly transparent.

Fig. 29.



By repose, the pus falls to the bottom of the receiver, where it forms a dense homogeneous stratum, of variable thickness, and of a yellowish-white or greenish-yellow tint. Under the microscope, it exhibits the appearance of spherical corpuscles (Fig. 29), floating in an albuminous fluid, opaque, white, rough on the surface, and more than one-third larger than the red particles of the blood. By agitation it readily mixes with the urine, to which it imparts its peculiar color, but is not dissolved in it. If a portion of the pus be mixed with an equal quantity of a solution of potash, it will form a dense, translucent, viscid compound, frequently so solid that the tube containing it may be inverted without any escaping. When putrefaction and alkalescence have commenced, the pus loses its distinctive characters; the globules disappear, and the whole fluid is transformed into a ropy, glairy substance, of a dirty, turbid aspect. The best test for detecting pus in the urine is its coagulability by potash. Its fatty matter, which presents itself in the form of yellowish, butter-like globules, may be extracted by the addition of ether. The albumen, which purulent urine always contains, is easily detected by heat and nitric acid.

The quantity of pus voided in the twenty-four hours varies from

a few drops to several drachms, according to the nature and extent of the concomitant lesion. An intelligent physician, aged thirty-six, who has labored for several years under disease of the urinary apparatus, accompanied with pain in the right kidney and deposits of oxalate of lime, informs me that he has, during the last fifteen months, discharged daily from half an ounce to an ounce. The greatest quantity is always observed in the morning, soon after waking. His health, in other respects, is tolerably good.

A substance, termed *kiesteine*, was detected in the urine, a few years ago, by Nauche. He supposed it to be peculiar to pregnant women, but it has since been ascertained to be generally present also during the early months of lactation, and sometimes also in the virgin state. When first observed it usually presents itself in the form of little, isolated patches, which gradually coalesce, and form a pellicle, from half a line to a line in thickness, of a whitish opaline tint, not unlike the greasy scum upon the surface of fat broth. Dr. Elisha K. Kane,¹ who has carefully investigated the physical properties of this substance, states that it occasionally makes its appearance in striated, irregular lines, somewhat similar to those of a spider's web, in rings, circles, trapeziums, and irregular figures of almost every shape, which become gradually obscured by the full development of the pellicle. It consists of a filamentous, flaky tissue, and is so coherent that it may occasionally be lifted off entire from the fluid which it covers. A portion of this substance commonly subsides, and forms a thin, bluish, or whitish layer at the bottom of the vessel. Its chemical nature has not been determined. Its smell sometimes resembles that of old cheese, but this is far from being constant. The time at which the pellicle appears varies. Dr. Kane has seen it well-marked at the end of thirty-six hours, and, on the other hand, he has known its appearance to be postponed until the eighth day.

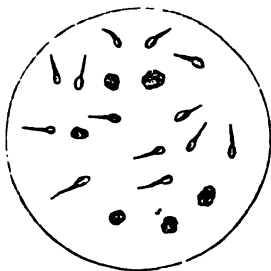
The urine sometimes contains *seminal fluid*, occasionally, indeed, at a comparatively early period of life, especially in boys subject to involuntary emissions, whether induced by masturbation, disease of the bladder, urethra, and prostate gland, ascarides in the rectum, or affections of the anus. In cases of tight stricture, the semen is very liable to pass back into the bladder, and to mingle with its contents, thus constituting one cause of impotence. The fluid usually occurs in such small quantity as to render it impossible to detect it with

¹ Amer. Journ. Med. Sciences, vol. iv. p. 18, N. Series.

the naked eye, but it may be so abundant as to form a distinct cloud at the bottom of the receiver, and to emit the nauseous and fetid odor so characteristic of its presence. Spermatic urine is preternaturally thick, opalescent, inordinately acid, and not clearable by heat and nitric acid. Very frequently it contains—rather, perhaps, as an accidental circumstance than as a necessary consequence of the seminal fluid—very minute crystals of oxalate of lime, in beautiful transparent double pyramids.

A drop of seminal urine, placed under the microscope, will be found to contain numerous *spermatozoa*, which, however, rarely retain their vitality beyond a few minutes, inasmuch as the urine proves almost immediately fatal to them. These animalcules present themselves as minute ovate, semi-transparent bodies, having each a delicate hair-like tail (Fig. 30), which is capable of very brisk movements, and which becomes always much more distinct where the urine is permitted to dry upon the object glass.

Fig. 30.



3. In the third place, the urine may be altered by the ingress of substances which, so far as we know, are not naturally contained in the blood. Amongst these, the most common are the cystic and xanthic oxides, oxalic acid, and a peculiar saccharine substance, like the sugar of grapes.

The cystic and xanthic oxides are never observed in healthy urine; they form the base of several varieties of vesical concretions, but the causes which predispose to their development are still unknown. Oxalic acid is more frequently seen and is often traceable to articles of diet which naturally possess a large quantity of this substance.

An abundant secretion of *sugar* is a circumstance by no means uncommon. In diabetes mellitus, where it is generally present in large proportion, it forms the characteristic feature of the disease. The urine in this complaint is commonly of a pale straw-color, of a faint, whey-like odor, and of a decidedly saccharine taste; it has a greater specific gravity than in health, yields a syrup by evaporation, has little tendency to putrefy, and is susceptible of undergoing the vinous fermentation. Diabetic urine almost always contains the usual proportions of saline matters; but, in the majority of cases, there is a great deficiency of urea and lithic acid. In a specimen of this fluid, examined by Mr. Kane, of England, 1000 parts were

found to be composed of 913 of water, 60 of sugar, 7 of urea, and 20 of salts.

The quantity of urine discharged in diabetes is sometimes surprising. Cases are on record, in which from two to four gallons have been voided every twenty-four hours for a number of weeks, and even months. The amount of saccharine matter is also very great. From some observations of Dr. Henry, of England, it appears that ten pints of diabetic urine, of the specific gravity of 1.040, contain upwards of a pound and a quarter of solid extract. The proximate cause of this disease is still unknown. From the facility with which the saccharine matter is furnished by the kidneys, it has been supposed to exist in the blood, and such, in fact, is the case, as has been shown by recent experiments. The kidneys are generally large and flabby, and there is almost always great disorder of the digestive apparatus.

Though *oil* is not contained in healthy urine, it is found in certain diseases. In one instance, Prout observed a substance like butter; and, in some cases, the fluid has the aspect of milk. Of oily urine, Raciborski has pointed out three varieties. In the first, the fluid is of a reddish-yellow color, and of a viscid, ropy consistence; in the second, it is of a mahogany brown. When this appearance is witnessed in acute diseases, it is always indicative, according to Landré-Beauvais, of great danger. In the third, the fatty matter floats on the surface of the urine, forming a thin pellicle, not unlike a spider's web.

The urine is occasionally of a *bluish* tint, owing to the presence of a peculiar coloring matter, which it holds in suspension. This substance, whatever may be its nature, is slightly soluble in boiling water and alcohol, has neither taste nor smell, and is entirely destroyed by nitric acid. Exposed to heat, it yields carbonate of ammonia and an empyreumatic oil.

The urine may likewise be of a *black* color, from the presence of melanic acid. When this substance is very abundant, the fluid has sometimes the appearance of black ink, or may be made such by the addition of an alkali. More frequently, a pink color is observed, owing to the presence of purpurine. Raciborski has often noticed this tint in rheumatic affections of the joints, of which, however, it is far from being diagnostic; and he has also witnessed it, though much less frequently, in catarrhal complaints of the chest.

The urine, under certain circumstances, deposits amorphous *sediments*, which Dr. Prout has arranged into several classes, the differ-

ence of color forming the basis of the division. They nearly all consist essentially of the lithate of ammonia, tinged with the coloring principle of the urine. The yellow sediment is characteristic of health; the pink, of hectic; the lateritious, of inflammatory fever. To this statement, however, there are numerous exceptions.

Lastly, the urine may contain *hairs*. Of this singular occurrence, highly interesting cases have been published by Magendie, Brodie, and some other writers. The hairs, which are occasionally quite numerous, are seldom more than a few lines in length, and they generally appear in combination with an excessive secretion of white, chalky matter. They are commonly of a whitish color, though sometimes they are black, auburn, or chestnut; and, being destitute of bulbs, they bear a much closer resemblance to the hairs of certain cysts and ovarian tumors than to those of the head. They may be soft or hard, straight or curled, abundant or few in number. The part which these hairs play in the formation of calculous concretions will be adverted to elsewhere. Whence these hairs are derived, we have no means of ascertaining. The subjects of most of the cases that have been reported were old men of intemperate habits.

4. The urine is liable to vary very much in its quantity, color, and odor. The subject is one of great practical moment, because the changes thus induced often serve as valuable indications of the condition not only of the urinary organs, but of the general system.

The *quantity* of urine, voided in the twenty-four hours, is subject to much diversity, depending upon different circumstances, as the season of the year, the state of the skin, the nature and quantity of our food, the presence or absence of disease, and the character of our remedies.

In England, according to Dr. Prout, the average quantity discharged in the twenty-four hours, varies from thirty to forty ounces. Dr. Routh,¹ on the contrary, estimates it at thirty-five ounces, this being the result obtained by him in eighteen cases. In France the quantity appears to be greater than in England, the difference depending, as is supposed, upon the diuretic influence of the subacid wines habitually used by the inhabitants of that country. M. Becquerel, who has carefully investigated the subject, fixes the average quantity at forty-three ounces for men, and forty-seven ounces for women. No observations have yet been made, so far as I am aware,

¹ London Medical Gazette for September, 1850.

with a view of settling this question in regard to the inhabitants of the United States. It is reasonable, however, to presume that the amount of secretion varies in different regions, being greater at the North than at the South, in consequence of the more feeble action of the cutaneous surface. The fact that more urine is voided in cold than in warm weather is familiar to every one. Huge feeders and drinkers pass more than the abstemious, and are, for this reason, more liable to renal disease. Severe exercise, and all inflammatory affections are attended with a diminished flow; the reverse being the case in repose, and in what are denominated nervous diseases, in which the quantity is often immense. In diabetes, from one to two gallons of urine are frequently voided, for weeks together, in the twenty-four hours. Diuretic medicines, as their name implies, act specifically upon the kidneys, and thus increase their secretion. It is worthy of remark that the approach of most inflammatory maladies is accompanied by a diminution, and the decline by an augmentation, of the renal secretion.

When the urine is unusually scanty, it generally contains a disproportionably small amount of water; its specific gravity is abnormally high, and its color is deeper than in the healthy state.

The *color* of the urine, which in health varies from a light amber to a pale straw, approaching red, is liable to be affected by disease, food, drink, medicine, mental emotion, and other circumstances.

It is well known that the urine is of a much higher color, as well as of greater specific gravity, in warm weather than in cold, and in strong, healthy, and robust persons than in such as are thin, feeble, and anemic. During the heat of summer, the renal secretion is constantly counteracted, as it were, by the cutaneous, and the consequence is, that it is not only considerably lessened in quantity, but materially heightened in color, the reverse being the case in cold weather. The urine is always of a deeper tint after severe exercise than after repose, after a hearty meal of meat than after one of vegetables, and after the use of brandy, wine, or malt liquors, than after the imbibition of water, tea, or milk. It is also of a higher color, generally speaking, in young and middle-aged persons, than in children and old subjects, in whom it is usually pale, dull, and cloudy. In inflammatory affections, as the different forms of fever, gout, rheumatism, pneumonia, pleurisy, and erysipelas, the fluid is always abnormally red, and frequently also turbid, from the presence of animal and earthy matter. It has less water, but more lithic acid,

is of higher specific gravity, and often contains a small quantity of albumen.

The urine is generally clear, and even remarkably limpid in nervous affections, as in hysteria, epilepsy, and hypochondriasis. The quantity in attacks of this kind is often very great, and the fluid is generally very thin and of low specific gravity. In diabetes, in which the urine is often thrown off in vast abundance, the color is usually very pale.

In jaundice, the urine often acquires a golden yellowish tint, and a somewhat similar effect is produced by the use of saffron, rhubarb, and turmeric. Beet-root renders the fluid red; mulberries and black cherries, dark; chalybeates, blackish. Infusions of madder, indigo, and logwood impart to the renal secretion their peculiar hue. Urine depositing cystine generally exhibits a pale yellow color, similar to that of honey.

The *odor* of the urine is liable to great variation, a circumstance deserving brief mention on account of its diagnostic bearing. In the healthy state, as has been already stated, it is slightly aromatic, without acidity, alkalinity, or feter of any kind; in fact, it strikingly resembles the odor of the perspiration of a sound person. In certain diseases, on the contrary, it often becomes remarkably offensive, even sometimes before it is voided. We frequently meet with this occurrence in injuries of the spinal cord, attended with paralysis of the inferior extremities. Very recently I attended, along with Professor Yandell, a case of paraplegia, occasioned by a fracture of the two lower cervical vertebræ, in which the urine, as it was drawn off by the catheter, exhaled a most powerful ammoniacal smell. In chronic disease of the bladder, dependent upon stone, stricture of the urethra, or enlargement of the prostate gland, the same circumstance not unfrequently occurs. The fluid, in this case, is always rapidly decomposed, often, indeed, before it is evacuated, and is usually exceedingly fetid. The odor of the urine which accompanies the deposit of cystine is very peculiar, bearing commonly a very close resemblance to that of sweetbrier; sometimes it is remarkably strong and fetid, like that of putrid cabbage, owing, probably, to the disengagement of sulphuretted hydrogen. The urine in diabetes has usually a sweet whey-like smell.

Certain articles of diet exert a powerful influence upon the odor of the urine. It has been long known that asparagus, garlic, onions, cauliflower, and other vegetable substances have the faculty of imparting their peculiar odor to the renal secretion. Similar

effects follow the exhibition of certain medicines, as oil of turpentine, copaiba, cubebs, fennel, valerian, castor, assafoetida, saffron, and other articles. Gin acts specifically on the kidney, and readily communicates its smell to the urine.

The *density* of the urine is liable to be influenced by various circumstances, as the age of the patient, the amount of perspiration, the nature of the diet, the state of the weather, and the character of the particular disease under which the individual may be laboring.

In health, it ranges, according to Dr. J. C. Gregory, in adult and middle life, from 1005 to 1033, the average of three hundred and sixty-three experiments on fifty individuals being 1022.5. It is greater, as a general rule, in adolescents than in children and old persons, and in males than in females. It is augmented by copious perspiration, by free exercise, by heat, by dry food, and, in short, by all articles containing much azote. The liberal use of water, on the contrary, of the lighter wines, malt liquors, and alcoholic drinks, vegetable food, cold, and sedentary habits, diminish it.

In disease, the density of this fluid varies from 1001, as the minimum, to 1055, as the maximum; showing, in the one case, a great diminution, and, in the other, a great increase, of solid material. Hence, as in health, the density of the urine does not, on the one hand, fall below 1005, or, on the other, rise above 1055, it follows that any considerable departure from either of these points should be regarded as an evidence of morbid action.

RULES FOR EXAMINING THE URINE.

The urine, as has been already stated, is liable to numerous morbid alterations, which can be detected only by a careful examination with the microscope and certain chemical reagents, with the nature and use of which every practitioner should render himself familiar. Simple inspection with the naked eye rarely furnishes any satisfactory results.

When it is intended to make a very accurate investigation, from four to eight ounces of what is called the morning urine should be selected. This should be put into a white glass bottle, which, being well corked, is allowed to stand for at least two hours, in order to afford its different constituents an opportunity of separating from each other. The observer now notes the color of the liquid, its transparency, the nature of the floating matter, and, finally, the character of the deposit. The fluid is next decanted into a tumbler, when the finger will be able to determine its consistence, and the

sense of smell its odor. If the urine be acid, it will turn blue litmus paper red, and red litmus paper blue if it be alkaline. An excess of acid is always indicated by the formation of a sandy brick-colored sediment within from twelve to twenty-four hours after the fluid has been voided. When the alkali is fixed in its character, the blue tint will be permanent; but if it has been produced by ammonia, the test paper will resume its original hue on the application of a gentle heat.

The alkaline urates are often present in solution in warm urine, being thrown down as it cools, and they are frequently of a red color, somewhat resembling the uric acid deposit; from which, however, they may be readily distinguished by their amorphous character and by their solubility in water heated to near the boiling point. Uric acid, which is insoluble both in hot and cold water, is distinctly granular, and frequently presents under the microscope well defined rhomboidal crystals. A mixture of the alkaline urates with uric acid can be most readily distinguished by this instrument.

The *specific gravity* of urine, which in the healthy state ranges between 1.009 and 1.030, may be very readily taken with a urinometer, a small tube delineated in the adjoining sketch (Fig. 31).

To do this, all that is necessary is to pour six or eight ounces of urine into a tall narrow cylindrical glass vessel, and, floating the instrument in the liquid, to observe the number on the graduated stem, where it is on a level with the surface of the water. This number, added to 1000, expresses the specific gravity.



Much more accurate results are afforded by the use of a specific gravity bottle. The one usually selected is capable of holding 1000 grains of distilled water at a temperature of 60° of Fahrenheit. The vessel, being counterpoised, is filled with urine, the weight of which will represent its specific gravity. When such a bottle is not at hand, a thin two ounce prescription vial may be employed. It should be provided with a good cork, furrowed at the side, to permit the escape of any excess of fluid from its neck, and be traversed, transversely, by a needle, so that it may always be pressed to the same depth. The vial is now filled with distilled water and carefully weighed; this being done, the fluid is replaced by the same bulk of urine, at the same temperature, and subjected to the same process. The weight of the urine, divided by the weight of the water, will give the specific gravity of the former liquid.

It should be borne in mind that the specific gravity of urine is greatly influenced by temperature, which in all reports of this fluid is estimated at 60° of Fahr. Thus, there is a difference of 6° in the specific gravity of urine at 40° and the same fluid at 70°. When the specific gravity is very high, it may be assumed that the fluid contains an undue proportion of solid matter, while, if it be very low, the probability is that it contains a large quantity of water.

The *solid matter* found in urine should be examined, not only with reagents, but also with the microscope, which often affords the quickest and most satisfactory results. It is rare, indeed, that a deposit consists of one substance alone; on the contrary, it is more usual to find two or more associated together. Hence, in applying our tests, the reactions are liable to be more or less masked in their appearance, thus rendering it necessary, in order to determine their true composition, to appeal to the microscope. An instrument provided with a half inch and a quarter inch achromatic object-glass, will be sufficient for all the purposes of an examination of this kind.

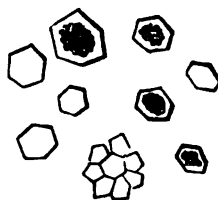
If the urine contain a sediment, a few drachms of it should be put into a test tube, and heated over a spirit lamp; if the sediment readily dissolves in the hot fluid, and is again precipitated on cooling, it is very probable that it consists of *urate of ammonia* or *urate of soda*. If heat does not cause a solution of the deposit, a few drops of acetic acid are added to a fresh portion of urine; if it is thereby dissolved, *earthy phosphates* are probably present, and the microscope will readily show whether the matter is *phosphate of lime* or *phosphate of magnesia and ammonia*. If acetic acid fail, another fresh portion of the fluid is tested with dilute muriatic acid. If it is dissolved by this means, and the clear liquid give a white precipitate on the addition of an excess of ammonia, it is an evidence that *oxalate of lime* is present. Should this substance also fail, it may be inferred that the sediment consists of *uric acid*. To determine this fact, the sediment is, first of all, to be separated from the fluid by a filter, on which it is next to be washed with a little water. A small portion, say a grain or two, is then put into a watch-glass and mixed with a few drops of pure nitric acid; the compound is now gently heated nearly to dryness, and, as soon as it becomes cold, a few drops of liquid ammonia are added, when it is again exposed to the lamp, and very gently heated as before. If a fine red or purple tint is produced, uric acid is present; if not, it is absent. For the microscopical character of this substance, see Fig. 32.

If the deposit is of a whitish or greenish white color, unalterable by heat or by dilute acetic, muriatic, or nitric acid, and readily

Fig. 32.



Fig. 33.



soluble in ammonia, it is probably *cystine*. In that event the ammoniacal solution will afford, on evaporation, microscopical crystalline plates of a hexagonal shape, as in Fig. 33. Cystic urine generally has an odor resembling that of sweetbrier.

If the urine contain a deposit of a greenish-yellow color, readily miscible, on agitation, with the fluid, and falling quickly afterwards to the bottom of the vessel, the inference is that *pus* is present. Urine containing pus always affords indications of the existence of albumen in the clear liquid. This substance may also be recognized by the property which it has of gelatinizing with liquor potassæ. For this purpose the sediment should be separated as completely as possible from the supernatant fluid, and mixed with a strong solution of potassa in a wide test tube; when, if there be pus, the compound will assume a thick, gelatinous consistence, rendering it frequently incapable of being poured out of the vessel in which it is contained. Under the microscope pus exhibits the appearance of globules, as described and figured at page 94.

The presence of *mucus* may be suspected when the deposit is of a thick, ropy, tenacious character, incapable of being mixed with the supernatant liquid. It is distinguished from pus, which it greatly resembles in its microscopical appearance, by its gelatinous aspect, by its want of reaction with liquor potassæ, and by the clear fluid in which the globules float not affording any evidence of the existence of albumen when tested by heat and nitric acid; unless, as is sometimes the case, the albumen is derived from some other and independent source. One of the most characteristic properties of mucus is its comportment with acetic acid. When urine in which this substance occurs as a deposit is treated with acetic acid, a thin

white, membranous mass is produced, a reaction which never happens with pus. The microscopical characters of mucus are detailed at page 90.

Urine containing *epithelial debris* presents to the naked eye nearly the same appearance as urine containing mucus, from which, however, it may be easily distinguished by its freedom from all viscid qualities, and by its peculiar microscopical characters.

If, in the absence of red urate of ammonia, the urine is red or dark colored, and a filtered portion of it affords indications of albumen, when treated by heat and nitric acid, *blood* is very probably present. In that event, the microscope will reveal the characteristic blood-disks, delineated in Figs. 27 and 28.

Urine containing *fatty*, or *chylous matter*, has usually an opaque milky appearance; and when viewed through a microscope of tolerably high power, minute transparent globules of oil will be seen floating through it. Sometimes the fatty substance is very intimately mixed with albuminous matter, forming with it a kind of emulsion, so as to render it impossible to recognize any of the peculiar globules under the microscope. When this is the case, the urine should be shaken with an equal portion of ether, and the ethereal solution gently evaporated, when, if fatty or chylous matter be present, the residue will exhibit the general characters of oils, such as their unctuous feel, their immiscibility with water, and their property of breaking up into distinct globules.

No general rule can be given for the detection of *albuminous urine*, as deduced from its physical properties; for such urine is exceedingly variable in its appearances and conditions. Thus, it may be acid, alkaline, or neutral; high-colored or pale; of high specific gravity or of low specific gravity. If, however, it be once suspected, it can be readily detected by chemical reagents.

If, when a few drachms of the suspected fluid have been carefully heated in a clean test tube over a spirit lamp, nearly to its boiling point, a whitish precipitate is produced, it may be concluded that it consists either of albumen or of earthy phosphates. To settle the question, a few drops of nitric acid are added, when, if the liquid becomes transparent, it is an evidence that the precipitate is phosphatic in its character; but if the acid fail to dissolve the sediment, and the latter remains as a whitish curdy mass, it must be regarded as being albuminous. If, when nitric acid alone is added to the suspected fluid, a whitish deposit is formed, the presumption is that it is albumen. But the most delicate test, though not perhaps so character-

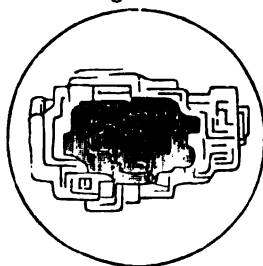
istic, is the production of a white precipitate on the addition of a solution of ferrocyanide of potassium, acidified with acetic acid. Neutral or alkaline urine should never be tested for albumen by heat without previously acidifying the fluid with nitric acid; and it is also advisable, in this case, to employ one or more confirmatory tests when the presence of this substance is indicated.

If the urine be of high specific gravity, pale-colored, and very abundant, *sugar* may be suspected to be present; but this substance occasionally exists in minute quantity in urine of low specific gravity. The best tests are *Trommer's*, and that by fermentation. The former is as follows: To a small quantity of urine in a large test tube a drop or two of a solution of sulphate of copper is added; the mixture being well shaken, a solution of potassa in quantity equal to about half that of the urine is poured into it. If sugar be present, the pale blue precipitate, first formed, will be redissolved, and instead of it there will be a purplish-blue solution. The mixture being now carefully heated and boiled for a few minutes, is set aside for a little while. If sugar be present, a reddish or yellowish precipitate will be formed.

The *fermentation test* consists in pouring a little fresh yeast into a test tube filled with the suspected urine. A small saucer is placed over the mouth of the tube, when both vessels are inverted, a small quantity of the same urine being afterwards put into the saucer to insure the perfect closure of the tube. They are now set aside in a quiet spot, where they should remain for a few days at a constant temperature of from 70° to 80° Fahr. Carbonic acid gas will be disengaged, which will ultimately fill the tube if enough sugar be present; a little gas will be given off by the yeast itself, and, in order to estimate its quantity, it is necessary to add the same amount of yeast to a test tube full of water, and invert it alongside of the other. If no sugar is present, no carbonic acid will be produced.

The high specific gravity of urine is sometimes owing to an ex-

Fig. 34.



cess of *urea*. This may be known by mixing with a small quantity of the urine, contained in a watch-glass, an equal bulk of colorless nitric acid, the mixture being afterwards set aside in a cool place. If urea exist in great excess, irregular rhomboidal plates, of a pearly lustre, of the nitrate of urea (Fig. 34), will form almost immediately, whereas,

if the excess be moderate, they will not appear until after the lapse of a little time.

The urine occasionally contains an excess of the *yellow coloring matter*. To determine this, a few drops of hydrochloric acid should be added to a small quantity of urine, heated to its boiling point in a test tube. If only a slight pinkish tint is produced, the amount of coloring matter is probably not abnormal, but if a red or crimson hue is produced, it is an indication that the pigment is superabundant.

If the urine is of a dark yellow or brown color, and of a very bitter taste, the existence of *biliary matter* may be inferred. As a confirmatory test, *Pettenkofer's* is considered as the best; it is as follows: The urine, freed from albumen—when this substance is present—by heat and filtration, is evaporated, especially if the suspected substance is in very minute quantity, nearly to dryness, and a very concentrated aqueous or alcoholic solution is made of the residue. A drachm of the urine, or of its aqueous or alcoholic extract, is then put into a test tube, and mixed with about two-thirds of a drachm of pure concentrated sulphuric acid gradually dropped into it. To this compound a grain of sugar or a drop of syrup must be added. If, on agitation, a red hue is produced, it may be concluded that biliary matter is present, the quantity being indicated by the intensity of the coloration.

Occasionally the urine is of a red color, somewhat similar to that produced by blood, but the microscope reveals no blood-disks; neither, in the great majority of cases, can albumen be detected in the clear fluid. The occurrence is probably caused by the presence of *purpurine*, which never exists as a sediment alone, but possesses the peculiar property of being precipitated from its solution by urate of ammonia. Hence, if purpurine and alkaline urates coexist, the purpurine is in the solid form combined with the salt. In order to detect the purpurine, the deposit should be separated from the fluid, washed with a little water, and digested with hot alcohol. The alcohol will dissolve the purpurine, and acquire a red color. If the purpurine is in solution in the urine, a hot solution of white urate of ammonia in water added to it will, on cooling, produce a red colored deposit.

DISEASES OF THE URINARY ORGANS.

PART I.

DISEASES AND INJURIES OF THE BLADDER.

CHAPTER I.

MALFORMATIONS AND IMPERFECTIONS.

SECTION I.

ABSENCE OF THE BLADDER.

MALFORMATIONS of the bladder are rare, and, in a practical point of view, not very important. They may be arranged under the following heads: 1. Absence of the bladder; 2. Bilobation, or multiplication of the organ; 3. Extrophy, or congenital eversion.

Absence of the bladder has been observed only in a few instances, which is not surprising when we consider how essential its presence is to the comfort and well-being of the system. When the defect exists, the ureters may open at one of three places: either into the rectum, the vagina, or directly into the urethra. The order of frequency of these different modes of termination has not been ascertained; but the probability is that it is as here enumerated.

When the ureters terminate in the rectum, the part is converted into a true cloaca, as in birds and reptiles. Richardson has published, in the seventh volume of the Philosophical Society of London, the history of a youth who lived seventeen years without ever having urinated by the penis. He passed all his water by the anus, and the only inconvenience which he experienced was a slight but continued diarrhoea. Haller¹ cites examples of the insertion of the ureters into the vagina.

¹ *Element. Physiol.* t. vii. p. 297.

A singular case of absence of the bladder was observed some years ago, by Dr. B. J. Raphael, of this city. The subject was a full-grown, healthy-looking infant, which, at birth, presented the following appearances. There was a tumor, about the size of a hen's egg, at the umbilicus, which evidently contained intestine, and which could be easily reduced, but always returned the moment that the pressure employed for that purpose was discontinued. The anus was imperforate, the testes had not descended, and the penis and scrotum existed merely in a rudimentary state. The posterior fontanelle was absent. The child died at the end of nine days. On dissection, the tumor above mentioned was found to contain nearly the whole mass of the small intestines, which were adherent to each other, and which terminated in the umbilical sac, where there was a discharge of meconium through an opening made by ulceration. The entire colon was wanting. No trace of a bladder could anywhere be detected. The left kidney occupied the usual position, but the right was situated in the right side of the pelvis. Both ureters terminated in the sac containing the small intestines. The sacrum was very broad, and filled up the space between the branches of the ischiatic bones, while the coccyx was prolonged forwards to an unnatural extent, and thus served, along with the bones just mentioned, to form the anterior wall of the pelvis, the pubic bones being absent.

A few instances are related in which the ureters were directly continuous with the urethra. Of these, the best authenticated, perhaps, is that of Binninger,¹ who observed it in the body of Abraham Clef, which he examined in the presence of several surgeons. The bladder was totally wanting. A probe introduced into the urethra could be readily passed alternately into the ureters, and from the ureters into the urethra; thus proving, beyond all doubt, that there was no intermediate sac. The kidneys were unusually large, and free from calculous concretions, although Clef had voided one some time before his death. The case loses much of its interest, from the fact that no account has been transmitted to us of the manner in which the subject of it voided his urine; whether this fluid was discharged involuntarily in drops, or under the influence of the will, and consequently in the ordinary manner. As there was no special dilatation of the ureters, answering the purpose of a bladder, it is altogether probable that the evacuation was incessant,

¹ Obs. Med. t. 2, c. 2.

as in extrophy, or congenital eversion of this organ. Clef had evidently studiously concealed his infirmity from his friends and physician.

SECTION II.

BILOBED AND ANOMALOUS BLADDER.

The bladder has been found divided into two or more compartments, either as a congenital defect, or as the result of disease. The internal septum upon which this arrangement depends is generally situated transversely, but occasionally it is directed obliquely, or even vertically. Of the latter variety an interesting example is recorded by Blasius.¹ The bladder of a man who died of phthisis was divided in the direction of its length into two equal portions, by a septum which extended from the superior part of the reservoir to its neck. Each compartment had a distinct ureter. Externally the organ appeared to be natural. Bussière, a member of the Royal Society of London, has published, in the *Philosophical Transactions* for 1701, a case in which the bladder was triple, or divided into three distinct compartments. It was discovered in a man who died in consequence of a vesical affection, the principal symptom of which was great difficulty in passing water, which was discharged in small quantity. On dissection, the bladder was found to consist of three pouches, sacs or chambers, of different capacities, the central one, which was regarded as the true organ, being intermediate in size between the other two, of which the right was the larger. The lateral pouches communicated with the main reservoir near its neck.

A still more remarkable example of malformation is recorded by Molinetti.² Here the individual, a female, had five bladders, five kidneys, and six ureters, of which two were inserted into the largest reservoir, while the remainder terminated each in one of the small sacs, which discharged their contents by special ducts into the main organs. This extraordinary number of bladders was the result altogether of an original vice of formation and not of disease.

A very singular case, in which the bladder was divided into two nearly equal parts, has been recorded by Bordenave. The patient had been subject to retention of urine, and the two sacs were situated the one behind the other, that which was regarded as the

¹ *Observ. Med. Rarior, Cum. Fig. ob. 19.*

² *Diss. Anat. Path. lib. 6, cap. 7.*

preternatural one having unusually thin walls. They communicated together by an opening of considerable size.

An instance, very similar to the above, occurred many years ago in the practice of Dr. Ruel Burrows, of Fryeburgh, Maine. The subject of it was a man, sixty-one years of age, who had long been in feeble health from distress in the urinary organs. For the last few years of his life, his abdomen was so much enlarged that it looked like that of a woman in the sixth or seventh month of pregnancy. He had long been affected with difficulty in voiding his urine, which, after having flown for some time, would suddenly cease, and not run again until after he had changed his posture, when it would generally issue very freely, often, indeed, to the extent of a quart at a time. The rectum was nearly closed by the mechanical pressure exerted by the enlarged bladder; but this, although no doubt a source of much suffering, did not occasion his death. His whole system seems to have been so thoroughly impregnated with urine that, during the last year of his life, he could taste nothing but this fluid, no matter what he ate. The functions of the stomach and bowels were thus effectually destroyed, and the man died probably exhausted.

The bladder, on dissection, was found to be sacculated. The supplementary cavity, which occupied the posterior portion of the organ, was capable of holding from one to two quarts of fluid, and communicated with the bladder, properly so called, by an oval aperture, one inch and a half in length. The coats of the viscus were comparatively thin in the former situation, but very thick and muscular in the latter. No mention is made of the condition of the rest of the urinary apparatus.¹

The annexed drawings, made by Dr. Gould, the accomplished naturalist, and sent to me by Dr. J. B. S. Jackson, the distinguished Professor of Pathological Anatomy in Harvard University, afford a beautiful view of this remarkable specimen of disease. Fig. 35 represents the exterior of the reservoir, and Fig. 36 the interior, with the opening of communication between the true and adventitious pouches. The organ, dried and inflated, is contained in the Anatomical Museum of the Boston Society for Medical Improvement, and measures, as Dr. Jackson informs me, in its present state, six inches and a quarter in height, and four inches and three-quarters in its transverse diameter.

¹ Dr. J. B. S. Jackson's Descriptive Catalogue of the Anatomical Museum of the Boston Society for Medical Improvement, p. 188, 1847.

Foubert¹ examined the body of an old officer, who had been subject for several years to retention of urine, in the posterior and upper

Fig. 35.



Fig. 36.



Fig. 35. Exterior of the organ. a. The bladder. b. The sac.

Fig. 36. Interior of the organ. a. The bladder. b. The sac, laid open, and showing, at c, the orifice of communication.

part of whose bladder there existed a depression of a conical form, the apex of which extended as far as the neck of the organ, and the interior of which lodged a portion of the ileum about six inches long. The bladder itself was large and relaxed.

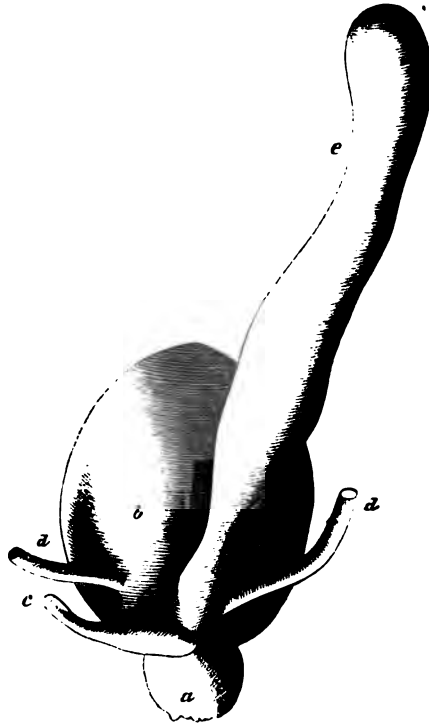
A case of congenital malformation of the bladder, of a very singular and unusual character, was published a few years ago by Dr. C. P. Johnson,² Professor of Anatomy and Physiology in the Medical College at Richmond, Virginia. It occurred in a male child eight months of age, who had suffered for several weeks previously to his death from violent paroxysms of pain in the hypogastric and umbilical regions. The chief point of interest was an abnormal pouch (Fig. 37), which, arising by a narrow pedicle from the lower and back part of the bladder, at the place naturally occupied by the right seminal vesicle, passed along the posterior wall of the bladder, about two inches above its upper border. It was about ten lines in diameter, of an irregularly cylindrical shape, hollow, and of the same structure as the bladder, with which it communicated by a small aperture just within and below the orifice of the right ureter. The pouch, at the time of the dissection, was found to be

¹ Mémoires de l'Académie Chirurg. t. 2, 26. Paris, 1819.

² Medical Examiner and Record of Medical Science, July, 1850, p. 381.

filled with urine. The bladder was of the natural size and form; and the prostate gland, the left seminal vesicle, and the two ureters occupied their usual position.

Fig. 87.



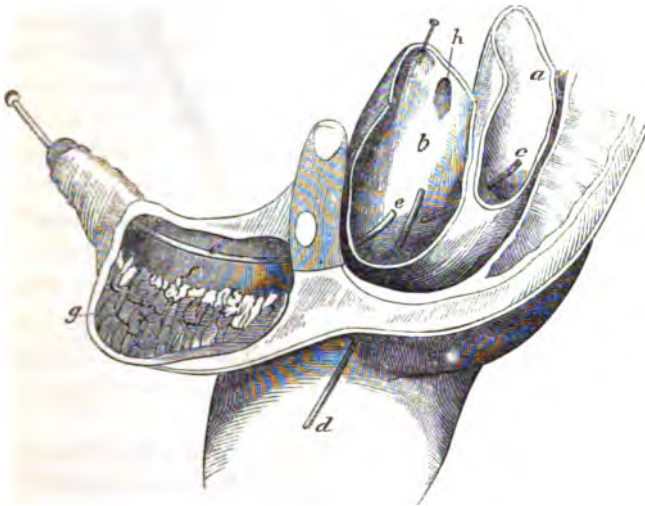
a. Prostate. b. Bladder. c. Deferential duct. d. d. Ureters. e. Abnormal sac.

A very curious, if not unique, case of malformation of the bladder was described, some years ago, by Mr. Bennett Lucas,¹ of London. It occurred in a male infant, otherwise well formed, who died a few days after birth, and who had voided both his urine and feces exclusively through the urethra. The situation of the anus was indicated by a red fleshy-looking tumor, about the size of a pea, which concealed an opening capable of admitting a small probe. On dissection, this opening was found to lead by a track from three to four inches in length to the interior of the bladder, its vesical extremity being guarded by a valvular fold of the mucous membrane. The rectum terminated some distance above the usual point, in a pouch

¹ *Cyclopedia of Surgery*, vol. i. p. 472. London, 1841.

which communicated, by a small orifice, with the urinary reservoir. The verumontanum, prostate gland, and seminal vesicles were absent, and the ureters were supposed to have opened into the ascending and descending portions of the colon, as no connection could be traced between them and the bladder. The situation of the deferential tubes was also overlooked in the examination, but it was afterwards ascertained that they had none of the usual relations. The scrotum, which had become distended with fluid two days before the infant expired, communicated with the urethra for fully

Fig. 38.



a. The rectum. b. The bladder. c. A probe passed through the recto-vesical orifice. d. An instrument indicating the track leading from the anus to the bladder. e. e. e. A probe lying in the urethra. f. The dilated portion of the urethra. g. The distended scrotum. h. A small cul-de-sac corresponding to the urachus.

half its length, and was lined with a coating of lymph, which prevented the urine and feces from being extravasated into the surrounding cellular tissue. The subjoined sketch, Fig. 38, conveys a very accurate idea of the parts here described.

Most of the cases of supernumerary bladder, recorded by the older anatomists, are of a very doubtful character. That nature is occasionally guilty of a freak of this kind may be easily imagined; but the occurrence is extremely unfrequent, and, unless attested by competent testimony, should always be received with great distrust. I am not aware that Morgagni, Haller, or Meckel, among

the older pathologists, or Lobstein, Cruveilhier, or Rokitansky, among the more recent, have met with a single example of such a malformation.

SECTION III.

EXTROPHY OF THE BLADDER.

The most remarkable malformation of the bladder, amounting, in fact, to a hideous monstrosity, is extrophy, or congenital inversion, a condition which consists essentially in the absence of the anterior wall of this viscus, and the protrusion of its posterior wall across an opening in the inferior part of the linea alba. The affection is fortunately rare, though it is said that Percy, in the course of his practice, witnessed not less than twenty cases of it; a circumstance which can only be accounted for by the fact that individuals thus afflicted usually resort to large cities in pursuit of charity and professional aid. However this may be, the experience of the French surgeon, in this respect, is without a parallel. I have myself seen but two examples of extrophy of this organ, one in a child, and the other in a young man, who has annually, for a number of years, visited the University of Louisville for the purpose of exhibiting himself to the medical class. The following are the most interesting points in this case, as derived from a careful personal examination in the winter of 1847.

Joseph Head, nineteen years old, a native of Rhode Island, is five feet six inches high and well formed, but has never enjoyed robust health, having had ten different attacks of bilious fever. His intelligence is very ordinary, and he is a painter by trade, but has never worked much at his business. He has a brother and a sister, who are both sound and well formed. Walking is painful to him, from the pressure and friction of his pantaloons upon the tumor; he constantly keeps the part covered with a thick, soft compress, to imbibe the urine, changing it five or six times a day. His bowels are habitually constipated. His body and limbs are well proportioned and well developed, but he has no beard.

The bladder is situated just above the pubic symphysis, in the median line, where it forms a rounded convex tumor, four inches in breadth by three inches and a quarter in height. The tumor is soft and elastic, has a red, raw appearance, bleeds easily when touched, and is tender and even painful on pressure. Its size is increased when the patient stands up, and diminished when he lies

down. The upper, central part of the tumor is covered with skin, a sort of imperfect copy of the original; everywhere else, it is red

Fig. 89.



Extrophy of the bladder. *a.* Everted bladder. *b, b.* Orifices of the ureters. *c.* Penis without urethra. *d, d.* Pubic symphysis. *e.* Scrotum and testis. *f.* Congenital inguinal hernia.

and raw. The skin, at its periphery, especially on the left side, is somewhat puckered, and has the aspect of a cicatrice. The orifices of the ureters, indicated by a frequent oozing, and an occasional jet of urine, are quite small, and one inch and three-eighths of an inch apart: the right is mammillated, and more prominent than the left. Between the tumor and the stunted penis a deep furrow exists, at the bottom of which are the mouths of the ejaculatory ducts, separated by an interval five-eighths of an inch in width.

The space between the pubic bones is four inches, and appears to be occupied by a dense, elastic structure, probably fibro-ligamentous in its character. The bodies and symphysis of these bones are evidently wanting.

The penis is imperforate, and consists of two rudimentary cavernous bodies. In its flaccid condition, it is upwards of two inches in its transverse diameter, and ten lines in the antero-posterior; it has a prepuce, and a tolerably distinct frænum in the usual situation. The organ is flattened above, where it is in contact with the tumor. During erection, it increases to nearly double the ordinary

size; the act, however, is unattended by any pleasurable sensation; on the contrary, it is always more or less painful, from the pressure which the distended organ exerts upon the tumor. A mucilaginous fluid, probably prostatic liquor, passes off involuntarily every day, and once or twice a week there are considerable seminal emissions, without any very agreeable feeling or emotion. The patient has at no time any amorous propensities.

The scrotum is smaller than usual, and covered by a few straggling hairs. The spermatic vessels and ducts appear to be of the natural size and consistence. The testicles are well formed: the left hangs lower than the right. There is a hernia on the right side, but the bowel does not descend into the scrotum.

No umbilicus is perceptible; one must, undoubtedly, have existed, but at what point cannot now be determined. Possibly, the umbilical vessels, which naturally run along the sides of the bladder, in their course towards the linea alba, may have issued at the place of union of the abdominal and vesical parietes, and thus prevented the formation of a navel, properly so called.

The groins are pretty thickly covered with hair, which extends unusually far outwards towards the spine of the ilium; it is of the ordinary length, and of the same color as that of the head.

The other case, above referred to, came under my observation some time ago, in a boy four years of age, whose parents reside at Jefferson City, Missouri. He is well-grown, very sprightly and intelligent, with blue eyes and light complexion.

The tumor, formed by the posterior wall of the bladder, is situated in a kind of hollow, or depression, bounded above by the umbilicus, and on each side by a fold of skin and cellular substance, enveloping the testes. Of a quadrilateral figure, but somewhat larger above than below, it is of a red scarlet color, and has a raw, tuberculated aspect. In its centre is a small perpendicular groove, about five lines in width, and extending nearly over its entire surface, which measures one inch in the vertical diameter by one inch and three-quarters in the transverse. The parts immediately around the tumor present the appearance of a cicatrice. The ureters open each upon a small red tubercle, just above and by the side of the penis, by a small, almost imperceptible orifice. The left tubercle is much larger than the right. A drop of urine gushes out at each opening every fifteen or twenty seconds. When the child is erect, the discharge is more frequent than when he is recumbent. The tumor is habitually covered with a mucous coating, and bleeds on the slightest

touch. The skin of the groins, of the upper part of the thighs, and of the scrotum, is constantly red and excoriated from the contact of the urine.

The penis is about one inch and one-eighth in length, rather thick and flattened, and open above in its whole extent, as in epispadias. The mucous membrane along this gutter is of a red, florid complexion, and is supplied with numerous and very distinct follicles. The head of the penis alone is visible in the natural state of the parts, the body being concealed by the vesical tumor. The prepuce is deficient above and at the sides; the remnant below, nine lines in width, and prolonged about two lines beyond the extremity of the organ, is hard and firm, bifurcated and provided with a distinct frænum. The testicles are quite diminutive, remarkably round, and situated in the groins, above the scrotum, which is very short and rugose, with a distinct raphé. The pubic bones appear to be separated from each other about one inch and three-quarters.

The umbilicus is situated at the superior boundary of the vesical tumor, and is quite flat when the boy is recumbent, but very prominent when he stands up. It has a smooth surface, and is of a circular form, with a central depression a little larger than a goose-quill.

The above cases are typical of all the examples of this variety of monstrosity that have been recorded by different observers as having occurred in the male. There are a few points, however, in the history of this affection which require brief notice.

The urinary tumor presents considerable diversity both as it respects its form, size, and color. In general, it is somewhat ovoidal, or globular; but, occasionally, it is very irregular, or nearly flat. Its volume is greatly influenced by the age and position of the subject. In the child, it rarely exceeds that of a walnut, while in the adult, when it has attained its maximum development, it may be as big as a fist, or a goose's egg. Very small when the subject is recumbent, it becomes quite prominent when he stands up, coughs, sneezes, or exerts himself much. The surface of the tumor is of a bright-red color, and is constantly covered with a mucous secretion, which protects it, in some degree, from the injurious impression of the atmosphere. In elderly subjects, the part is sometimes partially invested with a cutaneous pellicle, in consequence of which it is much less sensitive, or irritable, than in infancy, childhood, and adolescence, in which it is generally very tender, and apt to bleed on the slightest touch. The orifices of the ureters, generally situ-

ated at the inferior part of the tumor, are usually marked each by a small tubercle, or conical eminence, from which the urine constantly dribbles, rendering the person, unless very cleanly in his habits, uncomfortable to himself, and disgusting to those around him. The distance between the two apertures varies from one to two inches, according to the age of the subject.

In most cases, there is a separation of the pubic bones, or, more properly speaking, an absence of their bodies.¹ The interval between them varies, in different cases, from two and a half to five inches, according to the age of the subject and the width of the pelvis; and is occupied by a strong, dense, ligamentous substance, by which the gap is effectually closed. The cause of this condition is probably defective development, or an arrest of growth, similar in its nature to that of the soft parts. The pelvis is generally broader and flatter than in ordinary individuals, and the thighs are usually wider apart. A very common occurrence is inguinal hernia, sometimes on one, and sometimes on both sides.

The penis, always preternaturally short and flattened, is generally bent backwards, and furnished with an imperfect prepuce. The cavernous bodies, attached below to the ischium, as in the natural state, are small and narrow, and are not always united along the middle line, except just behind the head of the penis. This organ is sometimes imperforate, and at other times it presents a gutter along its upper surface for the lodgement of the lower half of the urethra. When this is the case, the posterior part of the canal displays the verumontanum, the mouths of the ejaculatory ducts, and the orifices of the prostatic canals. The prostate gland is generally present, but in a rudimentary state.

The seminal vesicles, always very diminutive, are sometimes represented by two small tubercles. Whatever may be their volume, they are invariably situated behind the inferior part of the fungous tumor. The ejaculatory ducts pursue their natural route, but are unusually small.

The scrotum is sometimes completely absent; at other times it exists merely in a rudimentary state. In the latter case, it may contain the testicles, while in the former, these organs are either lodged in the groins, or in a cutaneous bag at each side of the tumor. The testicles are sometimes normal; at other times, they are diminished in volume, or entirely absent; this, however, is rare.

¹ Cases in which no such separation existed are recorded by Denman, Walker, Coates, Roose, and other writers; but they appear, on the whole, to be rare.

The rectum is commonly natural, both in its situation and dimensions; sometimes it is considerably dilated, and sometimes, again, it is so much contracted as to give rise to great pain and difficulty in defecation.

The sexual appetite varies in different individuals; being entirely wanting in some, very weak in others, nearly normal in some, and in others, again, so great as to be, at times, a source of positive suffering. A remarkable instance of the latter peculiarity is given by Dr. Henry W. Ducachet, of New York, in the third volume of the *American Medical Recorder*. It occurred in a man, aged thirty years, whose testicles were large and well-formed, but the penis was impervious, and not more than an inch and a half in length. He confessed that his venereal desires were frequent and tormenting. Examples of a similar description are mentioned by other writers. The emissions, in most cases, are imperfect, and the erections are generally attended with a sense of uneasiness, if not actual pain. From the small size of the penis, and the peculiar conformation of the urethra, persons affected with this infirmity are necessarily incapable of procreating the species.

In the female, important changes are noticed in the genital organs. The clitoris may be absent, or it may deviate more or less from the normal standard. It is sometimes situated at one side of the median line, unusually small, or entirely absent. The attention of observers has not been specially directed to the condition of the urethra, and hence no precise intelligence has been elicited respecting it. The nymphæ are disunited, and imperfectly developed; the pudendal lips are either absent, or they are of moderate size, and covered with hair. In the latter case, they extend from the sides of the tumor towards the anus, without uniting, and without forming what is called the fourchette. The vagina usually exists in a rudimentary state; being preternaturally short, narrow, and flattened, with an uncommonly small orifice, which has sometimes the appearance of a transverse slit or fissure. The uterus is sometimes absent, sometimes rudimentary, sometimes fully developed. In the latter case, the subject may menstruate, and conceive, as in the interesting case recorded by Thiebault.¹ In the male, on the contrary, there must always be complete impotence, on account of the peculiar manner in which the ejaculatory ducts open upon the surface of the tumor.

Extrophy of the bladder is much more common in males than in

¹ Journal Général de Médecine, t. xxxiv. p. 178.

females, though the precise relative proportion has not been determined. The late Mr. Henry Earle,¹ of London, in a clinical lecture published in 1832, states that, in examining the various authorities upon the subject up to that period, he had found sixty-eight cases, of which sixty occurred in males. M. Isidore G. St. Hilaire, who has carefully examined the question in his *Histoire des Anomalies de l'Organization*, estimates the difference to be in the ratio of four to one. Of nine cases observed by Mr. H. M. McWhinnie,² of London, seven were males, and two females. Nearly all the cases of which I have seen accounts, either in professed treatises or in medical journals, occurred in males.

Extrophy of the bladder is utterly irremediable. All that can be done is to palliate the patient's suffering by attention to cleanliness, and by the use of a closely-fitting bottle for receiving the urine. When this cannot be obtained, the part must be kept constantly covered with a thick, soft compress, renewed as often as it becomes wet and disagreeable. The skin around may be protected, if necessary, with pomatum, simple cerate, or mutton suet.

Mathew Ussem, whose case figures so largely in the history of this variety of monstrosity, always wore, with great comfort, a kind of concave shield, constructed of tin, and closely fitted to the penis and vesical tumor. It terminated below, by means of a funnel, in a reservoir which hung between the thighs, and which he emptied whenever occasion required by uncorking a tube attached to the bottom part. By this contrivance, which served the purpose of an artificial bladder, and which is represented in the annexed sketch (Fig. 40), he kept himself perfectly clean, at the same time that he protected the parts from the contact and friction of his clothes. The apparatus, or rather a similar one, is seen applied in Fig. 41. A more suitable material than this, for such a contrivance, would be vulcanized caoutchouc, possessing, as it does, the twofold advantage of lightness and elasticity. Or, instead of this, gutta-percha might be used, especially if rendered flexible by the addition of a proper quantity of India rubber.

It has recently been proposed, to establish a channel for the conveyance of the urine from the bladder to the rectum, and in one instance the plan has actually been successfully employed, though not without seriously jeopardizing the patient's life. The operator

¹ London Medical and Surgical Journal, vol. i. p. 159. 1832.

² London Med. Gazette, N. S. vol. x. p. 860. 1850.

was Mr. Simon, Surgeon to St. Thomas's Hospital, London. The method consisted in making the ureters open into the rectum, which

Fig. 40.



Fig. 41.



Fig. 40. *a, a.* The shield for covering the bladder and penis. *b.* Loop for securing the apparatus round the body by means of a strap. *c.* Funnel. *d.* Reservoir. *e.* Tube for evacuating the urine.

was effected by passing instruments, armed with threads, from the former into the latter, the threads being afterwards retained until the communication was perfected. Violent constitutional symptoms ensued, and for a while the patient was in great danger, but he ultimately recovered, and was able to wear a pad, by which the opening in the abdomen was closed, and the urine forced into the bowel.

In another case, in which an attempt was made to establish an opening between the bladder and the rectum by means of a seton, the result was still more unfavorable. The operator, Mr. Lloyd, of St. Bartholomew's Hospital, London, in introducing the seton, happened to perforate the peritoneum, which is said to have descended unusually low along the posterior wall of the bladder. Acute inflammation took place, from the effects of which the patient perished in a few days. Had he survived, it was the intention of Mr. Lloyd to close the fissure in front of the abdomen, by paring its edges, and approximating them by means of the twisted suture, as in the common harelip operation.

It seems to me that a surgeon ought to hesitate a long time, in such an affection as this, before he undertakes an operation fraught

with so much danger. The affection is, at the worst, but an inconvenience, and it is questionable whether the plans proposed by Mr. Simon and Mr. Lloyd, even if they should be ever so successful, would place the patient really in a better or more comfortable condition than he was before. To void the urine by the rectum is hardly more desirable, or more agreeable, than to pass it in the way usual with such persons; but when it is remembered that the constant contact of so irritating a fluid with the mucous surface of the bowel may give rise to serious disease, there is an additional motive for discountenancing operative interference.

CHAPTER II.

INJURIES OF THE BLADDER.

SECTION I.

WOUNDS OF THE BLADDER.

It is remarkable how little information is to be found, in systematic treatises on surgery, on wounds of the bladder. From their silence, one would suppose that their authors were either totally unacquainted with the subject, or that they were afraid to discuss it. Their neglect to notice it cannot surely proceed from the infrequency of the occurrence of the accident, or from any want of pathological and practical interest which it may present.

Wounds of the bladder may be incised, punctured, lacerated, or gunshot, according to the kind of weapon with which they are inflicted. From the situation of the viscus, these injuries must always necessarily be complicated with lesion of the soft parts by which it is surrounded, and also not unfrequently with fracture of the pelvic bones.

The bladder, when empty, is so small, and consequently so well protected by the pelvic bones, that there is but little chance of its being wounded in an ordinary accident or rencounter. It is only when it is full, and projects some distance above the pubes, that it is liable to be laid open by sharp cutting instruments, as a sword, dirk, bayonet, spear, or splinter. A ball, however, may easily

penetrate it when it is empty, or when it is entirely concealed in the cavity in which it is naturally contained. Lacerated wounds are usually inflicted by blows, falls, or kicks upon the hypogastric region, by the pressure of the child's head in parturition, or by the body being forcibly jammed between two hard and resisting objects, as a post and the wheel of a carriage. In the same manner, the organ may be severely bruised. Baron Larrey describes the case of a soldier whose bladder was badly contused by the horn of a bull.

A wound, no matter how produced, may transfix the bladder, or merely pierce one of its walls; in the former case, there will be two openings; in the latter, only one. Again, the lesion may involve the serous investment of the organ, or it may take place in front and below where it is destitute of peritoneum. These circumstances, as will be presently seen, have an important influence upon the prognosis and treatment of the accident.

The best example of an *incised* wound of the bladder is the incision made in the supra-pubic and recto-vesical operations. In perineal lithotomy, the knife divides the prostate gland rather than the bladder. The best example of a punctured wound is that made by the trocar, for the purpose of drawing off the urine in cases of permanent retention from obstruction of the urethra.

The *symptoms* of this lesion are, the existence of an opening in the lower part of the hypogastric region, the groin, or the perineum; sudden and acute pain in the situation of the affected organ, extending along the urethra, and often accompanied by slight priapism; an escape of urine, or urine and blood, at the external wound; frequent but ineffectual attempts at micturition; violent tenesmus; and a discharge of blood from the urethra. The system labors under all the effects of a violent shock. The countenance is pale and ghastly, the breathing is hurried and oppressed, the pulse is small and feeble, the stomach is nauseated, and the surface is covered with a cold, clammy perspiration. When the injury is complicated with perforation of the bowel, fecal matter, mucus, bile, or gas, mixed with urine, or urine and blood, may issue both at the external opening and at the urethra. When the pelvic cavity is pierced, the state of collapse, the usual consequence of the accident, is speedily followed by symptoms of peritonitis, of which the patient almost always dies in two or three days. When the bladder is wounded through the perineum or above the pubes, at a point where it is uncovered by serous membrane, urinous infiltration is liable to take

place, and the probability of the occurrence will be so much the greater if the external opening is disproportionably small, if the track of the wound is narrow and devious, and if the organ was much distended at the time of the accident.

The discharge of urine at the external wound may be momentary, or it may last for a considerable period. It is sometimes continued; but for the most part it is intermittent, and exceedingly irregular in regard to its quantity. In some instances, all the urine escapes by the external wound, especially if this be situated in the perineum or in the rectum.

The following cases afford a good illustration of the nature, symptoms, prognosis, and termination of *punctured wounds* of the bladder. They show that injuries of this kind, even apparently of the most desperate character, may occasionally be recovered from with hardly any treatment.

CASE 1.¹—*Punctured wound of the bladder and rectum; violent cystitis and peritonitis; purulent and mucous urine; escape of fecal matter by the urethra; inability to bear the catheter; formation of sinuses; recovery.*

A gentleman, in coming down stairs, stepped upon a dust-shovel and brush, which had been carelessly left by the housemaid on the landing-place, and was precipitated from the top to the bottom, with his legs somewhat extended. Being very large and cumbersome, he fell with great force against the handle of the brush, the extremity of which was driven into his body, entering very near the verge of the anus, and passing through the rectum into the bladder as far as the pubic bones. Violent cystitis ensued, followed by peritonitis. Six weeks after the accident, the urine, which was loaded with an immense quantity of pus and mucus, was voided by the wound in the rectum, and fecal matter escaped by the urethra. By the advice of a physician, a gum-elastic catheter had been retained in the bladder, with the hope of affording the parts an opportunity of uniting, but severe suffering coming on, the instrument was withdrawn. The patient, in short, was in great agony, for the relief of which he took a large dose of opium. As soon as the medicine began to act, the urinary organs became relaxed, and shortly thereafter, "a part of his trousers and drawers," forced into the bladder at the time of the accident, was passed by the urethra. Several sinuses being laid open, the wound soon healed, and the discharge of pus in the urine gradually diminished, but the mucus continued for some time longer, when it also disappeared. Complete recovery ensued.

CASE 2.²—*Wound of the perineum and bladder; fistulous state of the part; retention of a large piece of wood in the bladder; extraction of the foreign body; recovery.*

A boy, ascending from a coal-pit, fell, in consequence of the breaking of the rope, with his perineum upon the end of a piece of wood, which looked very much like a hedge-stake, and which entered the bladder. After some time, the wound became

¹ Bingham's Practical Essay on Diseases and Injuries of the Bladder, p. 463. London, 1822.

² Bingham, *op. cit.* p. 461.

fatalous, and refused to heal. A very careful examination being made, it was ascertained that a large piece of the wood had broken off, and still remained in the bladder; this being extracted, the wound soon began to granulate, and finally closed.

*CASE 3.*¹—*Wound of the perineum by a thowl-pin; formation of a large abscess; escape of urine at the site of the original injury; spontaneous cure; afterwards symptoms of stone; lithotomy; recovery.*

William Howell, aged fifty-three years, bookbinder, was admitted into the Royal Infirmary, Edinburgh, on the 18th of October, 1853, on account of an injury received eleven years previously. It appears that, while stepping into a fishing boat, he fell backwards on the "thowl-pin," which entered the perineum immediately at the posterior margin of the right side of the anus. Very little hemorrhage occurred, and, although he felt faint, he was still able, when he landed, to walk home, a distance of a quarter of a mile, without assistance. Severe febrile symptoms, however, soon appeared, followed by inflammation of the lower bowel, and, in ten days, by a large abscess in the perineum. This at length burst at the seat of the injury, discharging a quantity of dark, fetid pus, with great relief to his sufferings. Three days after this he observed, while at stool, that a part of his urine escaped through the abnormal opening, and that the rest, which passed off by the urethra, was mixed with air. Things continued in this manner until the following March, about five months after the accident, when the wound completely and permanently closed. The general health was now restored, and he was free from all suffering, except after considerable exercise, when he had frequent calls to void his urine, which, at these times, was always mixed with blood, and the evacuation of which was invariably accompanied with hot, burning pains in the region of the bladder. A few weeks after this, and about a month after the cicatrization of the wound, he observed, for the first time, that the stream of water was suddenly interrupted, as if by some body plugging up the channel. The symptoms continuing, and the man being at the same time troubled with severe lancinating pains in the perineum and penis, the sound was introduced, but no stone was detected; the urine, however, although free from blood, deposited a copious sediment of ropy mucus, and on several occasions he voided, by the urethra, one or two elongated, friable bodies, like splinters of wood, white, rough, and easily broken down with the finger.

The patient continued pretty much in the same condition until about two years and a half before his admission, when, during a long confinement, occasioned by a fracture of the tibia, his vesical symptoms became greatly relieved, and he was able to pass his water without any difficulty or uneasiness. On resuming his occupation, however, all his former troubles returned with great severity; he had frequent and painful micturition, and the stream of urine was often completely obstructed, the fluid being generally mixed with pus and blood after the slightest exertion. Some months after this he was again sounded, when a calculus was detected; but as he refused to submit to an operation, none but palliative remedies were used. At length, however, his suffering became insupportable, and Dr. Dunsmore removed a stone, having for its nucleus a portion of the drawers and trowsers which the man had worn at the time of the accident. He made a speedy and complete recovery.

¹ Ranking's Half-Yearly Abstract of the Medical Sciences, No. 19, January to June, 1854, p. 151. Phila. edition.

CASE 4.—Wound of the thigh and bladder by a stake; escape of all the urine by the abnormal opening; use of the catheter; antiphlogistic remedies; rapid recovery.

The following case of punctured wound of the urinary bladder is related by Dr. Schütte,¹ of Mulheim, in Germany. A healthy man, thirty-seven years of age, fell perpendicularly from a height of about eight feet on an upright wooden stake several feet long, and fully an inch thick. Its end penetrated the inner surface of the left thigh, about three inches from the rectum, and opened the lower part of the urinary bladder above its sphincter muscle. The urine flowed continually and insensibly through the wound; but none passed by the urethra. A catheter was placed in the organ; and leeches, cold lotions, and poultices were successively applied externally. The patient was kept on light food, and in about three weeks the wound had healed without any ill consequences.

Gunshot wounds of the bladder, although, perhaps, less fatal than punctured and incised wounds, are often extremely formidable, destroying the patient immediately or remotely, producing extensive mischief among the soft parts, as well as in the pelvic bones, and leading to the formation of abscesses, sinuses, and fistules, which may last for months and years, and render life utterly miserable. When the ball is impelled with great velocity, it will be apt to enter the organ at one point, and pass out directly opposite at another, thus leaving two apertures, and either lodging in the neighborhood, or issuing at the surface of the body. If, on the contrary, it move slowly, or be nearly spent, it will be likely to make only one opening, and to be arrested in the bladder, from which it may ultimately be discharged by the urethra, or by a fistulous passage; or, what is more probable, it will become incrustated with earthy matter, and thus form the nucleus of a calculus. The lesion is often complicated with fracture of the pelvic bones, injury of the large vessels, and perforation of the rectum, the small intestines, the uterus, or the vagina. In the former case, serious mischief is sometimes done by the osseous splinters which the ball makes and detaches in its course towards the bladder, and which not unfrequently find their way into the interior of this organ, where they may give rise even to more disastrous consequences than the ball itself. Wadding, pieces of cloth, or portions of the patient's attire, may accompany the ball, and be temporarily or permanently retained in the bladder.

In a gunshot wound, the danger of extravasation is not always in the first instance, but sometimes secondary. The ball may have penetrated the coats of the organ obliquely or in a sort of valvular manner, or it may have been unusually small. In either of these

¹ American Journ. Med. Sciences, N. S. i. p. 517.

cases, the urine may not escape at all, or the occurrence may be postponed until the separation of the sloughs. This will usually happen at some period from the seventh to the twelfth day, and during this time the patient should be closely watched, otherwise serious, if not fatal, mischief may be the result. Barzellotti¹ relates the case of a medical student, shot through the bladder in a duel, who did not die from the peritonitis, consequent upon the extravasation of urine, until the twentieth day after the accident. It is probable that a piece of wadding or cloth may temporarily occlude the wound, and so prevent the effusion of the contents of the organ.

It has been already stated that the ball, if lodged in the bladder, is variously disposed of. In the generality of cases, it soon becomes incrustated with earthy matter, which gradually increases in quantity until a considerable-sized calculus is the result, producing all the symptoms of a common concretion, and requiring, perhaps, the operation of lithotomy for its removal. More rarely, the ball causes ulcerative absorption, and is finally discharged through the perineum, or the rectum; usually the latter, since it always has a tendency to fall into the *bas-fond* of the bladder. It is possible that the foreign body may become encysted, without producing any decided symptoms. When the ball is very small, it may escape externally through the urethra; but such an occurrence must necessarily be rare. The only instance, in fact, of this kind, of which I have any knowledge, is that related by Bonetus. After the external wound had entirely cicatrized, and the patient was apparently well, he began to experience sharp pains, similar to those caused by a stone in the bladder. One day, in a violent effort at micturition, the ball, which was composed of lead, and of the size of a pea, was expelled through the urethra.

Pieces of wadding, of cloth, and of bone, introduced into the bladder, either alone, or in union with the ball, are frequently discharged through the urethra. Sometimes, however, they are retained, and form the nucleus of a calculous concretion.

In the following case, related by Mr. J. Douglass,² of Hawick, two pieces of bone were discharged by the urethra some time after the occurrence of the accident.

¹ *Questioni di Med. Leg.* t. iii. p. 174.

² *Edinburgh Medical and Surgical Journal*, vol. xiii. p. 818. 1817.

CASE 1.—A captain in the British service was wounded at the battle of Chippewa, on the 5th of July, 1814. The ball, having penetrated the left groin, over Poupart's ligament, by the side of the femoral vessels, fractured the anterior part of the pelvis, and passed through the bladder in an oblique direction, lodging beneath the integuments over the right sciatic notch, from which it was immediately extracted. The wound bled copiously, and the urine was drawn off, soon after its infliction, with the catheter. Mr. Douglass did not see him until about the fourth day. His countenance at that time was pale and anxious, the pulse quick, the respiration hurried, and the urine, tinged with blood, flowed freely from the groin. The wound in the buttock, from which the ball had been extracted, looked clean and healthy, while the one in the groin was inflamed and sloughy. He made frequent attempts to void his urine by the natural passage, but, after the most painful and convulsive efforts, he could not effect it. The introduction of the catheter was also tried, but ineffectually, owing to the severe spasms which it excited in the perineum. An enema was given, and an opiate taken at bedtime. On the following morning, a slender piece of bone, nearly an inch in length, and about the thickness of a crowquill, presented itself at the urethra, from which it was immediately extracted. He had spent a restless night; but the expulsion of the foreign body had afforded him a good deal of relief. Very little alteration occurred during the next three weeks, except that the wound in the groin assumed a more healthy appearance, and that he could now void, though not without the most severe pain, a few drops of urine by the natural channel. The discharge of pus and urine was also copious, and so extremely fetid that it was difficult to remain in the apartment for any length of time. The posterior wound now began to inflame and suppurate, followed by the escape of urine and a piece of cloth. At this time, also, another piece of bone was passed by the urethra. The season becoming extremely hot, the wound in the groin was overrun with maggots, which for a short time greatly augmented the patient's suffering, but were finally destroyed by injections of brandy and water. After this, the sores began to contract, and to be filled with healthy granulations, while the bladder gradually resumed its accustomed functions. Their final closure, however, was much retarded by frequent attacks of intermittent fever, but this was finally accomplished at the end of about three months and a half. Subsequently, he took cold, and during the exertion of coughing, the wound in the groin was forced open, and the urine was again discharged at that point. As his health improved, it gradually contracted, and was completely and permanently healed in six weeks. Mr. Douglass adds that, after his recovery, he was compelled, in voiding his urine, to stoop a good deal, and to compress his abdominal muscles with his hands, in order to facilitate its expulsion. He also complained, at intervals, of pain in his groin, and of debility in the lumbar region. His bladder was not irritable, for he could retain his water for almost any length of time.

CASE 2.—A soldier, whose case was observed by Mr. Guthrie,¹ of London, and which we shall give nearly in the language of the reporter, was wounded on the heights of Vera, in the Pyrenees. A musket ball had entered behind, near the sacrum, and had lodged. He was bled twice on account of pain in the parts, but did not suffer much in other respects. For a time, he experienced difficulty in voiding his urine, but this gradually subsided, although he always had pain in micturition, which was frequent and distressing. He remained in this state until December, when he passed with considerable effort, and after much difficulty, a hard piece of his jacket, about half an

¹ Commentaries on the Surgery of the War in Portugal, Spain, France, and the Netherlands, p. 574. London, 1853.

inch in length, and larger than the orifice of the urethra, through which it was forced. As it was not incased by calcareous matter, Mr. Guthrie judged that it could not have been long retained in the bladder, but must have been lodged near it before it ulcerated its way in, giving rise to the irritation and constant desire to urinate which he had so long felt. After the expulsion had taken place, the symptoms gradually subsided, though they had not entirely disappeared when he left for England.

Wounds of the bladder, however small or insignificant, are amongst the most *dangerous* accidents to which a human being is exposed. It was formerly considered that all such lesions were necessarily fatal within a short period of their occurrence. Modern observation, however, has long since disproved the validity of this conclusion, by showing that recoveries are by no means infrequent, and that, too, under circumstances apparently the most desperate. When the opening is small, and penetrates the cavity of the bladder obliquely, the viscous being at the same time nearly or quite empty, effusion of urine may be prevented, and reparation effected by the adhesive process. A wound involving a part of the bladder that is uncovered by peritoneum, is less dangerous than one in which this membrane is injured. The urine in the former case escapes into the subserous cellular tissue, where, although it may awaken severe inflammation, followed perhaps, by abscess or gangrene, it is less deleterious than when it finds its way into the general cavity of the abdomen, where its presence almost invariably causes death in a few days. A wound inflicted upon a distended bladder is, in general, more hazardous than one inflicted upon an empty bladder, because there is more risk of effusion of urine, and the consequent development of excessive inflammatory action. A wound of the inferior part of the bladder is less likely to prove serious than one affecting the body or fundus of the organ; and a gunshot wound than an incised or punctured one. Of the truth of the latter remark the statement of Dr. Thomson, in his *Report of Observations made in the Military Hospitals of Belgium*, affords a striking and convincing illustration. "We saw," says he, "no fewer than fourteen cases recovering, in which the bladder had been penetrated by musket-balls." The testimony of Baron Larrey,¹ who met with a number of cases of gunshot wounds of this organ during Bonaparte's campaigns in Egypt and Syria, is equally flattering. "Wounds of the bladder," he says, "in general, terminated well."

The following cases are subjoined in illustration of the nature,

¹ *Memoirs of Military Surgery*, translated by Dr. Hall, vol. i. p. 321. Baltimore, 1814.

symptoms, treatment, and termination of *gunshot wounds* of the bladder. Allusion to a number of others will be found in the chapter on foreign bodies in this organ.

CASE 1.—*Wound of the abdomen and groin; escape of urine; high fever and tympanitis; use of the catheter; recovery.*

A soldier was wounded at the siege of Charleroi by a ball which entered at the left side of the inferior part of the abdomen, immediately above the crest of the iliac bone, and issued very near the right external inguinal ring. M. Poneyés, who saw him on the fourth day after the accident, found him in a state of delirium, with high fever and tympanitis, the dressing being saturated with urine, which escaped in large quantity upon dilating the wounds. What added to the danger of the case was the fact that the man had just recovered from a severe attack of sickness. Bleeding and fomentations were employed, with some simple ointments to the parts, but without much benefit. As no water passed by the urethra, the catheter was used, and afforded great relief by emptying the bladder, not only of urine, but also of several small clots of blood and shreds of membrane. Under this treatment the inflammation of the bladder gradually diminished, and in six weeks the wounds were completely healed.¹

CASE 2.—*Wound of the hypogastrium and sacrum; escape of urine and fecal matter by the posterior opening; mild symptoms; recovery.*

Captain Martin, at the siege of Ciudad Rodrigo, was struck by a musket ball just above the pubes; it passed through the pelvis, perforating the bladder and rectum, and coming out behind at the sacrum, which it splintered. The contents of both organs were freely discharged through this opening. As he suffered hardly any inconvenience from the urine, very little of which passed by the urethra, this passage was not, in the first instance, examined. The inflammation was restricted within proper limits, the rectum was carefully washed out with emollient enemata, and the lightest possible diet was enjoined. Under this mode of management, the patient gradually improved; the anterior wound healed first, and then the posterior; and in a comparatively short time he was well enough to leave for Lisbon on his way to England.²

CASE 3.—*Wound of the buttock and bladder; lodgement of the ball in the latter organ; symptoms of urinary calculus; extraction of the foreign body by the perineal section; recovery.*

"Gunshot wounds of the bladder," says Colles,³ "are not always mortal. I saw a man who received a ball that went exactly through the sciatic notch, and penetrated the cavity of the bladder; it did not go through, but lodged in the bladder. After some time, the patient found that he could not make water, but after a deal of effort, a piece, or rather two pieces of cloth, which were rolled up into a ball and had lodged in his urethra, were shot out, and he then made water freely enough; but the ball still remained in his bladder, and the only inconvenience he felt was that he could only make water while lying on his side. He could not make a drop in the erect posi-

¹ Manuel de Chirurgien D'Armée, Par M. Percy, p. 246. Paris, 1830.

² Commentaries on the Surgery of the War in Portugal, Spain, France, and the Netherlands, by G. J. Guthrie, p. 576. London, 1858.

³ Lectures on the Theory and Practice of Surgery, edited by Simon M'Coy, Esq., p. 133. Philada. 1845.

tion, and he afterwards submitted to the operation of having it cut out. The ball, although it had remained in the bladder twelve months, had not the slightest appearance of incrustation."

CASE 4.—Wound of the hypogastrium and nates; escape of urine and feces at both orifices; sloughing; constant retention of the catheter; recovery.

Francis Chaumette, of the 22d regiment of cavalry, was wounded at the battle of Tabor, the ball passing through the hypogastric region, across the pelvis, to that point of the left buttock which is opposite the sciatic notch. The direction of the foreign body and the escape of urine and feces at both orifices clearly indicated the nature and extent of the injury. M. Milioz, who had the surgical direction of General Kleber's division of the army, carefully pursued the plan that had been so successfully adopted at Acre. Suppuration came on, followed by fever, and there was an abundant discharge of pus on the separation of the sloughs. A catheter, constantly retained in the bladder, prevented the infiltration of urine, and facilitated the adhesion of the edges of the vesical wounds, which healed before those of the rectum. The man was perfectly well upon his arrival at Cairo some time after the accident.¹

CASE 5.—Wound of the buttock, perineum, and thigh; escape of urine and feces by the lower orifice; tenesmus, fever, and sloughing; use of the catheter; recovery.

A corporal of the 9th demi-brigade, about twenty-seven years of age, was shot in the assault at Acre. The ball passed through the pelvis, entering the right buttock near the ischiatic tuberosity, and emerging at the left side of the perineum, in the situation of the wound made in the lateral operation of lithotomy. It then turned forward to the right, elevating a portion of the three-headed femoral muscle, and issuing at the right groin near Poupart's ligament and on the inside of the femoral vessels, which, however, remained intact. The sudden discharge of urine at the lower orifice and the involuntary escape of feces produced by the rupture of the sphincter muscle, showed that both the bladder and rectum had been injured. The patient labored under acute pain, nervous agitation, and almost insupportable tenesmus. Fever set in soon after the accident, and continued pretty high until the separation of the eschars. Baron Larrey freely dilated the external wound, and introduced a gum-elastic catheter, to prevent urinary infiltration. A tent anointed with cerate was placed into the rectum, and enemata with cooling drinks were prescribed. The man was very ill until the ninth day, when, the sloughs coming away, the symptoms abated. He passed but little urine and feces by the lower orifice. The wound on the buttock healed first, and then that of the groin; but the opening in the perineum did not close under six weeks. The patient recovered completely, without incontinence of urine or feces.

CASE 6.—Wound of the buttock and scrotum; perforation of the neck of the bladder; gangrene of the scrotum from infiltration of urine; urinary fistula; use of the catheter; recovery.

Desjardins, a fusileer of the 82d demi-brigade, was struck in a sortie of the garrison of Acre by a ball, which, entering at the left sciatic notch, passed through the pelvis to the scrotum of the right side, where it lodged. The neck of the bladder was perforated at two opposite points, and the urine insinuated itself into the scrotum, which swelled prodigiously, and fell into gangrene. The wound made by the entrance of the

¹ I am indebted for this and the two following cases to Baron Larrey's *Memoirs of Military Surgery*, translated by Dr. Hall, vol. i. p. 821. Baltimore, 1814.

ball was dilated, and the affected parts were freely scarified, to arrest the mortification, and assist nature in detaching the sloughs. Meanwhile, the infiltration of urine was prevented by the constant use of the gum-elastic catheter. The patient suffered a great deal, but, at the end of a fortnight, he began to improve; the eschars gradually separated, and the posterior wound soon closed, but that of the scrotum remained open a long time. When Baron Larrey returned to Egypt, there was still a urinary fistule, but this disappeared soon after, and Desjardins got entirely well.

"Many other similar cases," says Baron Larrey, "occurred in the different engagements which we have since had, and all the wounded recovered by the same treatment. General Bon alone died of an injury of this kind, because he would not permit the wounds to be dilated, nor a catheter to be introduced into the bladder. The diffusion of urine soon produced gangrene, which was promoted by the corpulency of the general."

Incised and punctured wounds, on the contrary, nearly always prove fatal, and it was doubtless upon this circumstance that Hippocrates founded his famous aphorism, "*Cui persecta vesica lethale.*" Finally, much of the success, in curable cases, depends upon our treatment, and the co-operation of the patient and his attendants.

In the *treatment* of a wounded bladder, two prominent indications are presented: first, to prevent extravasation of urine; and secondly, the occurrence of undue inflammation.

Unfortunately, the first of these accidents often takes place at the moment of the injury, and consequently before the surgeon has an opportunity of interfering. When the bladder is distended, it matters not where it is laid open, whether at a part invested by peritoneum or not, effusion of urine will be inevitable; the danger of the case will thus be increased, in an instant, an hundred-fold. When the general cavity of the abdomen is penetrated, the contact of the fluid will in a few hours set up intense peritonitis, which no skill can possibly control. The disease proceeds in spite of the best directed efforts to combat it. This being the fact, the patient's only chance consists in preventing its occurrence. This is to be attempted by attention to position, and by the instant evacuation of the bladder. The patient should be placed almost semi-erect in bed, and the catheter, which should be of gum-elastic, should be left in the bladder, where it is to be secured in the usual manner, to enable the urine to pass off as fast as it comes down from the ureters. In a word, the organ should be kept constantly empty and contracted for the first fifteen or twenty days, or until there is reason to conclude that the wound is closed, and all risk of infiltration over. The end of the instrument must not be permitted to become clogged, or to rise up in the bladder, otherwise the object for which it is em-

ployed will not be attained. Care should also be taken that it do not press or rub against the mucous membrane, and thereby excite pain, spasm, or irritation, rendering its presence uncomfortable, if not intolerable. Should the latter result, however, follow, the catheter must be withdrawn, and an attempt made to obviate the danger of distension by the frequent introduction of the instrument.

The development of undue inflammation is to be prevented by the employment of antiphlogistic means. Foremost amongst these are general and local bleeding, calomel and opium, hot fomentations, and vesication of the abdomen. Anodynes must be given in full doses, both by the mouth and by the rectum, to allay pain and spasm of the bladder, induce sleep, and diminish the renal secretion. The drinks must be cooling and demulcent, the diet perfectly light and bland, and the bowels must be disturbed as little as possible during the first eight or ten days. No drastic purgatives are admissible. The best aperients are castor oil and sulphate of magnesia. Cathartic enemata must be avoided, on account of the pain and irritation which they produce by their pressure on the bladder. Abscesses, the result of urinous infiltration, are to be opened by early and free incisions.

Nothing can be gained by an attempt to extract the foreign body, when the injury has been produced by fire-arms; for the very moment it is inflicted the urine escapes, and the bladder contracts upon itself so as to destroy the relations between the external and internal wounds. If the ball has fallen into the bladder, it may, if not too large, either pass off spontaneously, or be removed with the forceps; should it be otherwise, and severe symptoms be caused by its presence, it must be cut out through the perineum by an operation similar to that of lithotomy. This may be done immediately or within a short period after the accident, if the ball has entered beneath the pubes, for the reason that the organ will not only be freed thereby of a disagreeable intruder, but also because there will be less risk of urinous infiltration.

When the bladder has been transfixed, or wounded through the peritoneum, the accident, as all experience proves, inevitably terminates fatally. In view of this event, would it be proper to make an incision through the linea alba, and sponge out the extravasated fluid? My opinion is that it would, and that it would be much more creditable to a surgeon to perform such an operation, provided it can be done immediately after the injury has been received, than

to stand by, and see his patient perish from the effects of peritonitis. The only difficulty in the case might be the uncertainty of the abdominal effusion.

SECTION II.

LACERATION OF THE BLADDER.

The urinary bladder, like the other hollow organs, as the heart, uterus, stomach, and intestines, is liable to laceration, from over-distension from its contents, or from external violence. The accident, although generally fatal, is of sufficient importance both in a pathological and practical point of view, to require brief notice in a work expressly devoted to the consideration of the injuries and diseases of the urinary passages.

When the laceration takes place as a consequence of the inordinate accumulation of urine from paralysis of the muscular fibres of the bladder, hypertrophy of the prostate gland, or obstruction of the urethra, there is almost always some degree of softening of the different coats of the organ, thus predisposing them to this occurrence. In such a case, it is only necessary for the patient to use some unusual or sudden exertion, such as sneezing, vomiting, or straining at stool or micturition, to produce the effect in question. Indeed, the mere effort of turning about in bed might bring it on. The pressure of the diaphragm and the abdominal muscles under such circumstances upon the over-distended viscus, is equivalent to a tolerably severe blow, kick, or fall upon the hypogastric region, the most common cause of the accident when it results from external injury. A similar predisposition is sometimes established by the ulcerative process, and by excessive inflammatory action, eventuating in partial gangrene. The laceration when thus produced usually occurs at the fundus of the bladder, and is generally of small extent.

But the most common *cause* of the accident is external violence, and it is worthy of remark, both in a surgical and a medico-legal point of view, that it may occur from the most trivial injury. Any force suddenly applied to the hypogastric region, as a smart blow, a kick, or a fall, will frequently suffice to produce it. For the force, however, to be effective, it is necessary that the bladder should be distended at the time of the accident. If it is empty, or only partially filled with urine, the blow, unless directed with great precision, will be inoperative. The laceration most commonly occurs in a scuffle, in which the individual receives the weight of the body of his anta-

gonist upon his abdomen, or in which this part is struck with the head, hand, elbow, foot, or knee. It may also be caused by a fall from a considerable height, by the pelvis being jammed between two hard and resisting objects, as a wall and the wheel of a carriage, or by striking the hypogastric region against a post, a stone, or the corner of a table. Mr. R. W. Smith, of Dublin, describes a case in which the laceration was produced by the person, a female, fifty years of age, falling, while in a state of intoxication, across the edge of a tub. The accident is liable to occur in females during parturition, in consequence of the pressure of the child's head, when the patient has neglected to empty the bladder. A case is mentioned by Mr. Hey,¹ in which the fundus of the organ suddenly gave way on the fifth day after confinement, probably from injury sustained during labor. A large quantity of urine was found in the peritoneal cavity. The bladder is sometimes torn in the operation of lithotripsy, and also during the extraction of the calculus after the operation of lithotomy. The accident occasionally happens from over-distension of the bladder, consequent upon retroversion of the uterus; or during the attempts which are necessary to restore the dislocated organ to its natural position.

The *age* of the patient does not appear to exert any marked influence upon laceration of the bladder from mechanical causes, whether these causes act through the abdominal parietes, through the uterus, or through the pelvic bones. Laceration depending upon over-distension of the bladder is most common in old subjects, in whom the powers of life have been enfeebled by protracted suffering, and is usually associated with softening, and attenuation of the different tunics of the organ. King,² Howship,³ and Malgaigne,⁴ have each published a case of the accident as occurring in the foetus. The lesion, from both causes, is, for obvious reasons, more common in males than in females.

When caused by external violence, the lesion may be *complicated* with fracture of the pelvic bones, laceration of some of the parenchymatous organs, as the spleen, liver, or kidney, and injury of the vessels, attended with internal hemorrhage. It is worthy of notice, especially in a medico-legal point of view, that it may occur without any mark of violence upon the surface. In many cases, however,

¹ Howship on the Urinary Organs, p. 253.

² Guy's Hospital Reports, ii. p. 510.

³ *Op. cit.*

⁴ Vidal, *Traité de Pathol. Externe*, t. v. Sec. ed.

there is more or less contusion with ecchymosis of the skin, cellular tissue, and muscles of the hypogastric region, and sometimes also of the pubes and perineum.

The *rent* may be perpendicular, oblique, or transverse. Its edges are uneven, ragged, and everted. In some instances it is considerably diminished in size by a protrusion of the mucous membrane; and now and then it looks as if it had been made with a punch or sharp instrument. In extent it varies from a few lines to several inches, being at one time so small as hardly to admit a common-sized quill, and at another so large as to receive a small fist. Several lacerations occasionally exist, but usually there is only one. There is no regularity in regard to the seat of the lesion. It is most common, however, in the posterior wall of the bladder, next in the anterior wall, then at the fundus, and lastly at the *bas-fond*. The neck also sometimes suffers; and cases occur in which the viscus is literally torn from its attachments to the pelvic bones.

The peritoneal coat alone may be torn, but this is rare; on the other hand, this coat may retain its integrity, and all the rest give way. This distinction is not imaginary, but real, and, as will be shown presently, has an important bearing upon the diagnosis and treatment of the injury. It leads, moreover, to a division of the lesion into partial and complete. In the former variety, the urine, instead of escaping into the abdominal cavity, is extensively infiltrated into the subserous cellular tissue of the bladder, of the pelvis, and of the abdominal muscles, and the peritoneum, at the seat of the lesion, bulges out in the form of a small translucent pouch.

The accident usually reveals itself by well-marked *symptoms*, both general and local. Violent pain is instantly experienced in the hypogastric region, the face is pale and ghastly, the pulse is small, rapid, and fluttering, the respiration is hurried and difficult, the extremities are cold, and the surface is covered with a clammy perspiration. The patient occasionally falls down in a state of insensibility, as if he had been struck on the head or stomach; but this is not always the case; for sometimes he is able to walk about, and perhaps go some distance before bad symptoms appear. Not unfrequently he feels as if something had burst or given way in his abdomen, attended, perhaps, with a crack, or audible noise. In nearly all cases there is a constant desire to urinate, and an inability to pass a single drop of water. A small quantity of blood often flows by the urethra. These symptoms are soon followed by nausea, and vomiting, intense thirst, excessive restlessness, and an expression of

intensive suffering, with swelling and tenderness of the abdomen. The period of collapse may last from a few minutes to several hours or even days, and the patient may die from the shock of the system, or reaction may occur, and he may perish from the effects of peritonitis.

The introduction of the catheter is generally followed by a flow of bloody or turbid urine, and not unfrequently by blood alone, either fluid, or partly fluid, and partly coagulated. The instrument enters without difficulty, and the point sometimes passes through the rent in the bladder into the peritoneal cavity, where it may be made to move about in different directions, and even be felt by the finger across the walls of the abdomen.

Of these symptoms, the most worthy of reliance, in a *diagnostic* point of view, because the most constant, are the sudden pain in the hypogastric region, a frequent but fruitless effort to urinate, an escape of blood by the urethra, the inability of the surgeon to relieve the bladder with the catheter, and the rapid collapse of the system. The sensation of tearing, or giving way, is often absent, and so is also the crack or audible noise. The character of the pain is not to be disregarded. It always comes on at the moment of the laceration, and is generally so violent as to induce extreme faintness with all the other symptoms of prostration. It may be sharp or lancinating, hot or burning, colicky or cramp-like. The symptoms now enumerated, added to the history of the case, leave no doubt in regard to the nature of the lesion.

In laceration of the bladder external to the peritoneum, or in the partial variety of the affection, the symptoms are equally severe in the first instance, but the reaction generally takes place sooner, and there is a longer interval between it and the occurrence of peritonitis. The pain during this period is less violent, the abdomen is not so tender under pressure, the pulse is not so much depressed, and there is less prostration of strength. More urine, too, flows by the catheter.

The state of collapse having continued for some time, is at length followed by a certain amount of reaction, which is itself speedily succeeded by symptoms of peritonitis. The countenance now becomes flushed, the skin is hot and dry, the pulse is small, quick, and wiry, the belly is tympanitic and exquisitely tender on pressure, the limbs are drawn up to relax the abdominal muscles, the respiration is quick and hurried, and the patient is often delirious at an early period of the attack. By and by, hiccup sets in with bilious vomit-

ing, the pulse fails at the wrist, the surface is bathed with a cold clammy sweat of a urinous odor, the countenance becomes Hippocratic, and the patient falls into a state of coma, under which he gradually expires.

On *dissection*, the ruptured organ is usually found to be very much contracted, and hardly ever contains more than a few drachms of urine. In some instances, especially in the partial varieties of the lesion, it is considerably dilated, from the presence of coagulated blood.

The edges of the rent are generally ragged, sloughy, and of a deep red or purple color; and the lining membrane of the organ exhibits evidence of high inflammatory action. All the tunics, in fact, are frequently softened, and altered in their appearance. The surface of the bladder is incrustated with lymph, and united to the neighboring parts; the intestines adhere to each other; the peritoneum is highly injected, and of a deep red color; and the abdominal cavity contains more or less urine mixed with serum, lymph, and blood. In protracted cases, there is sometimes, in addition to these fluids, an effusion of pus. The quantity of urine present may be very small, or it may amount to several quarts. The same remark applies to the accumulated blood. When death occurs soon after the accident, neither the bladder nor the peritoneum exhibits any marked evidence of inflammation. In partial rupture, the subserous cellular tissue of the bladder, of the pelvic cavity, and of the abdominal muscles, is gangrenous, and infiltrated with urine; the peritoneum is highly inflamed; the bladder is softened and discolored; and the abdominal cavity contains more or less serum and lymph.

Sometimes the inflammation is limited to the neighborhood of the bladder, and an effort is made by nature to repair the injury by an abundant effusion of lymph. In this manner a sort of adventitious sac may be formed, in which the urine, or the urine and blood may accumulate, and thus be prevented from inducing fatal peritonitis.

Laceration of the bladder is nearly always *fatal*. Indeed, there are, so far as I know, scarcely half a dozen cases of recovery from this injury upon record.

Death usually takes place in from three to six days after the occurrence of the accident. It may, however, be postponed until a later period; and a case is mentioned by Dr. E. R. Peaslee,¹ of Maine, where the patient, a man, aged thirty years, survived forty-two days.

¹ Amer. Journal Med. Sciences, N. S. vol. xix. p. 388, 1850.

The laceration was situated at the neck of the bladder, and was complicated with wound of the perineum and fracture of the pelvic bones. Large abscesses were found in both iliac regions after death.

The immediate source of danger from laceration of the bladder is the poisonous effect which the urine exerts upon the nervous system, and which, together with the excruciating pain, appears to be the cause of the collapse into which the patient so frequently falls almost at the moment of the accident. The depression and suffering may be so great as to occasion death in a few minutes, or, at furthest, in a few hours.

Another source of danger is the consequent hemorrhage, which is profuse in proportion to the extent of the laceration, and the size of the injured vessels. When the accident is complicated with fracture of the pelvic bones, a large artery or vein may be implicated, and the individual may speedily sink from exhaustion. The amount of hemorrhage cannot be estimated by the quantity of blood which escapes by the urethra; the bleeding goes on internally, and the fluid collects in the bladder or pelvic cavity. When the blood exists in large quantity, and in a solid state, it may form a hard tumor, which can be easily felt by the hand upon the abdomen or the finger in the rectum.

Soon after the first edition of this work was put to press, a valuable paper on rupture of the bladder was published by Dr. Stephen Smith,¹ assistant surgeon to the Bellevue Hospital, New York. It is based upon an analysis of seventy-eight cases, reported by different observers, and constitutes the most elaborate and interesting monograph that has yet appeared on the subject. The following summary comprises the most important facts contained in it.

Of the seventy-eight patients, whose cases were analyzed by Dr. Smith, sixty-seven were males, and eleven females; making the proportion of the former to the latter nearly as six to one. Three were under ten years of age; three between ten and twenty; nineteen between twenty and thirty; twenty-six between thirty and forty; seven between forty and fifty; and four between fifty and sixty. The ages of the other patients, who were adults, is not given.

The cause of the accident was direct violence in forty-eight of the cases; in fifteen, concussion of the body; in four, parturition; in one, retroversion of the uterus; and in four, stricture of the urethra. In the remainder of the cases, the nature of the cause is not specified.

¹ New York Journal of Med. and Surg. N. S. vol. vi. p. 374, 1851.

Seven of the patients felt a sensation at the moment of the accident as of the bladder bursting.

The primary symptoms are stated to have been severe in fifty-nine of the cases, and it is worthy of note that in forty-three of these the rupture extended into the peritoneal cavity. In nine, of which seven likewise affected the peritoneal cavity, the symptoms were slight, and in three they were entirely absent. In twenty-eight of the cases, there was, from the beginning, inability to urinate; in three, on the contrary, the bladder retained its expulsive power. Bloody urine was drawn in twenty-five cases, and clear urine in four. In seven of the cases, the patients were able to walk after the occurrence of the injury.

In fifty of the cases, the rupture affected the cavity of the peritoneum, thirty-nine being caused by direct violence, six by concussion or indirect violence, four by parturition, two by stricture of the urethra, and one by retroversion of the uterus. In nine of the cases, the rent existed in the anterior wall of the bladder: of these, five were induced by external injury, one by stricture, and three by concussion. Rupture of the neck of the organ was present in six cases, in five of which it was caused by direct violence. In seventeen of the cases, the bladder was firmly contracted, and in two it was not discovered on the dissection of the body. In thirty-four of the cases, in twenty-seven of which the laceration involved the peritoneum, there were marks of inflammation in the abdomen, while in seven no lesion of the kind was detected. Fracture and injury of the pelvis existed in fifteen cases. In nearly all there was an absence of evidence of external violence.

Of the seventy-eight patients seventy-three died; thirty-nine within the first five days, twenty-two between five and ten days, two between ten and fifteen days, three between fifteen and twenty days, one above twenty days, and one at the end of forty-two days. In those who died soonest, and they constituted the great majority, the rent extended into the peritoneal cavity. In the five patients that recovered, the lesion, in one, was partial, in one it involved the peritoneal cavity, and in three it extended into the cellular tissue.

I subjoin the following cases in further illustration of the causes, symptoms, and fatal termination of this accident.

CASE 1.—Severe and protracted shock; violent pain and distress in the pelvic region; frequent desire and fruitless efforts to pass water; death on the third day; laceration of the anterior wall of the bladder; fracture of the pubic bone; absence of peritonitis.

C. Grimer, aged fifty years, farmer, was admitted into the Louisville Marine Hospital, under the care of Dr. William H. Cobb, March 17, 1852, at 4 o'clock in the

afternoon, on account of an injury of the pelvis, received a few hours previously by being jammed violently between a railroad car and the edge of the floor of the Louisville depot. He was intoxicated at the time. A physician who saw him a few minutes after the accident did not think that he was much hurt, and therefore made no particular prescription for him. He very soon, however, began to complain of severe pain in the pelvic region, with a constant and urgent desire to void his urine, every effort of which proved abortive. At the time of his admission he was in great suffering; he was pale and chilly, there was hardly any pulse at the wrist, and he was excessively restless and thirsty. A small superficial abrasion existed on each hip, giving the surface an ecchymotic appearance. As soon as he was put in bed he drew up his limbs, and seemed afterwards to prefer that posture to any other. About three hours after his admission, Dr. Fisher introduced a catheter, and drew off three ounces of urine, mixed with red fluid blood, but without any relief. The instrument entered very easily; it was not known what quantity of urine the bladder contained at the time of the accident. The inclination to empty the bladder obstinately continued, and during the next two days the man occasionally passed a little urine, of the character already mentioned, by his own efforts.

The pulse remained feeble, indeed, hardly perceptible, until early the following morning, March 18, when, under the influence of brandy, camphor, morphia, and ammonia, with sinapisms and warmth to the extremities, moderate reaction took place. In the afternoon, when, in the absence of Dr. Cobb, I visited him, the pulse was tolerably full, soft, and about ninety-eight in the minute; the skin was warm and moist; and the mind clear and calm. The countenance, however, was pale, and the desire to urinate still frequent, though less urgent. The abdomen was quite tender on pressure, especially over the hypogastric region, but there was no particular distension. The patient was thirsty and restless. He had, during the early part of the day, taken, along with his stimulants, three grains of calomel with one grain of opium every three hours, and the abdomen, which was now exquisitely tender, hard, and tense, though but slightly tympanitic, had been kept constantly covered with a large emollient poultice. This was now discontinued, and a large blister substituted in its place. The use of the ammonia was also suspended.

The patient had no sound sleep at any time during his brief illness, and the unnatural desire to void his urine continued up to the moment of his death, which occurred at 5 o'clock on Saturday morning, March 20. During the last twelve hours he did not pass a drop. The pain, which was nearly incessant, was most severe in the pubic and the lower part of the hypogastric regions, and was always much increased by pressure and by change of posture. The evening before he expired, the patient had several alvine evacuations from a dose of oil taken the previous morning.

The body was inspected five hours after death. The abdomen was full and tense, but only slightly tympanitic, and the skin and cellular tissue were entirely free from marks of violence. On dividing the walls of the abdomen, an ecchymosis, about two inches in diameter, was found beneath the parietal portion of the peritoneum, just below the inferior true ribs on the left side, near the middle line, and a short distance below this was another but smaller one. The muscles for about five inches above the pubes, and for some distance beyond each side of the middle line, were infiltrated with blood and urine, and were at least three inches thick. On carrying the incision down to the pubic symphysis, a rent, of a rounded shape, and nearly one inch in diameter, with slightly ragged edges, was discovered in the anterior wall of the bladder, below the serous investment, through which the urine had escaped into the surrounding structures. The bladder, which was a good deal contracted, contained a little urine and a few small coagula. The mucous membrane presented no abnormal appearance, except

immediately around the wound, where there were evidences of high inflammation. The urethra was sound. The perineum and the cellular tissue of the groins and pelvis were infiltrated with bloody urine. The ramus of the right pubic bone was broken off at the junction with its body, in an oblique direction, so as to form a sharp fragment, which, inclining backwards towards the bladder, had probably caused the fissure in its anterior wall, already described. About a pint of bloody serum was contained in the peritoneal cavity, but there was no sign whatever of peritoneal inflammation. The abdominal viscera were all healthy.

CASE 2.—Violent shock; extreme pain in the hips and pelvis; bloody urine; death at the end of ten days; laceration of the neck of the bladder; fracture of the pubic bone; peritonitis; urine, blood, and pus in the abdominal cavity.

Lewis George, twenty-two years of age, of healthy constitution, and temperate habits, on the 9th of June, 1852, while digging a cellar, was caught by the falling earth, and embedded as high as the umbilicus. During the fall which attended the accident, he was struck on the left hip and side, his knees being at the moment drawn up towards the abdomen. Dr. Anderson saw him about three hours after he was hurt. He found him very pale and feeble, with a profuse diarrhoea, and excruciating pain in the hips and pelvic region. The perineum, pubes, and nates exhibited a bruised appearance. The treatment consisted of cups, fomentations, and large doses of Dover's powder, followed, after reaction was fully established, by antiphlogistic remedies. The abdomen seemed to be hard and distended from the commencement; and the urine, which was drawn off regularly twice a day, was always very bloody. Death took place on the 19th of June, ten days after the occurrence of the accident.

The intestines were firmly united to each other and to the bladder by an abundance of lymph; a large quantity of urine, mixed with blood and pus, occupied the peritoneal cavity; and a small rupture existed at the lower and back part of the neck of the bladder, permitting the escape of its contents. The mucous membrane seemed to be free from inflammation. A fracture, large enough to admit the end of the index finger, was found in the ramus of the right pubic bone.

CASE 3.—Severe shock; excessive pain in the right groin and pelvis; inability to void urine; catheterism followed by nothing but blood; tympanitis and tenderness of the abdomen; death on the third day.

S. B., aged nineteen, a stout, healthy youth, on the evening of the 5th of April, 1861, was thrown from the top of a stage coach, the corner of which, in the act of upsetting, fell upon his right hip and thigh. The parts were severely bruised, and, upon attempting to rise, he was unable to support himself upon his limbs. Dr. Murray, a physician of the neighborhood in which the accident occurred, saw him within a short time after, and administered brandy and morphia to induce reaction and allay pain. When I reached him, about three hours and a half after he was hurt, he appeared comparatively comfortable, with a good soft pulse, and an inclination to sleep. He, however, spent a restless night, and in the morning he was carried to his mother's house, distant about one mile and a half. At my visit in the forenoon, Dr. Murray informed me that he had voided no urine, and, upon introducing the catheter, nothing but fluid blood followed the withdrawal of the instrument. The abdomen was somewhat tender on pressure, but not tympanitic; the pulse was rather small and feeble, the thirst was urgent, and there was a disposition to drowsiness and delirium. During the following afternoon and night, the symptoms assumed a more serious and alarming character; nothing but blood followed the repeated use of the catheter; the abdomen became more full and tender; the pain increased in violence; and on the

succeeding night, a little upwards of forty-eight hours after the accident, he expired. No examination of the body was permitted; a circumstance which is much to be regretted, although it is perfectly certain, from the nature of the symptoms of the case, that there must have been rupture of the bladder, with, perhaps, fracture of the pelvic bones.

*CASE 4.*¹—*Excessive prostration; bloody urine; death on the second day; laceration of the upper and anterior part of the bladder; extensive peritonitis; half a gallon of fluid in the abdominal cavity.*

Francis Smith, aged forty, an Irishman, and a laborer, was admitted into the New York Hospital, March 21, 1860, on account of an injury which he had received two hours previously by a stone, weighing four hundred pounds, falling upon his abdomen from a height of three feet. He was very much prostrated, with a feeble pulse, and a cold, clammy state of the skin. He was about to relieve his bladder when the accident occurred, but did not do so. As soon as he entered the ward he was desirous of urinating, but being unable, the catheter was introduced, and less than a pint of fluid draws off. The water was discolored, and the instrument contained a clot of blood. Brandy having been freely administered, partial reaction took place in an hour, when the catheter was again used, and this time upwards of a pint of urine came away, not in a jet, but slowly and with difficulty.

The patient remained comparatively comfortable until the day after the accident, when his strength began to fail, and vomiting ensued; he spent a bad night, and the next morning he was found to be in a state of complete collapse, the pulse being absent at the wrist, the surface cold, the breathing hurried and labored, and the countenance expressive of the deepest anxiety. The catheter was again passed, but no water followed. Death took place in less than forty-eight hours after the occurrence of the injury.

The cavity of the abdomen contained four pints of fluid, intermixed with urine. The peritoneum was extensively inflamed, and the intestines were distended with gas. The bladder was found to be ruptured at its upper and anterior surface, three inches from its connections with the pubic bones, the opening being sufficiently capacious to admit three fingers; it was much contracted, and lay very low down in the pelvis.

CASE 5.—*Prostration; pain in the pubic and pelvic regions; discoloration of the abdomen; ability to urinate; death forty-eight hours after the accident; laceration of the fundus of the bladder; fracture of the pelvic bones.*

Levis Grey, aged eighteen years, a fireman, was admitted into the New York Hospital, December 18, 1849, having been caught twelve hours previously between two railway cars, which were precipitated through a bridge. He complained of pain across the pelvis and in the situation of the bladder, aggravated by the slightest pressure. The right side of the abdomen, from the pubes to the iliac crest, appeared to be bruised and discolored. There was also some fulness in the perineum. He had voided no urine since the accident. A catheter was introduced with some difficulty into the bladder, and a small quantity of bloody urine evacuated. The surface was cool, and the pulse feeble. On the second day after his admission his mind was

¹ I am indebted for this and the succeeding case to the "Case Book" of the New York Hospital. The specimens, marked 658 and 659, are preserved in the beautiful Museum of that institution, and were kindly submitted to my inspection by Dr. Watson and Dr. Bowen.

observed to wander, but he could pass his water without any difficulty, and with sufficient force to project it to a distance of two feet; the stomach was irritable, and he expired about forty-eight hours after the receipt of the injury.

The body was inspected three hours after death. The pelvic bones were found to be fractured, and the bladder, contracted to the volume of a goose's egg, was lacerated at its fundus. Its walls were half an inch thick, but free from disease. No mention is made as to the condition of the peritoneum, and the presence or absence of fluid in its cavity.

Not much need be said about the *treatment* of this lesion. It is obvious, from what has been already stated, that no measures, however well directed, will, in general, be of any avail in saving life. Immediate quietude in the recumbent posture must be enjoined, and reaction must be promoted by a recourse to the usual remedies. The moment this is established, blood should be taken freely from the arm, and the belly should be covered with leeches, followed by hot fomentations. The application of a large blister will often be serviceable in moderating and circumscribing the resulting inflammation, the chief object in the treatment after the occurrence of reaction; the warm bath sometimes affords great relief. The further effusion of urine is prevented by the frequent introduction of the catheter; or, when the patient can bear it, by the permanent retention of the instrument in the bladder. In general, however, all the mischief that can be done, is done in the first instance by the escape of the urine into the peritoneal cavity, from which it will not be in the power of the surgeon to remove it, or to prevent its pernicious effects. Keeping the patient constantly in the semi-erect posture may be of use when the rent is situated at the fundus or posterior surface of the bladder. When the laceration is partial, or when the peritoneal coat retains its integrity, benefit might be derived from free incisions, practised above the pubes or through the perineum. In such a case, the urine is generally extensively infiltrated into the cellular tissue of these parts, and its progress is often indicated by an erysipelatous blush, which thus serves as a guide to the knife.

In a case of rupture of the bladder, external to the peritoneum, in a man twenty-three years of age, Dr. Walker,¹ of Boston, performed the lateral operation as for stone, and thus not only secured a free outlet for the infiltrated urine, but prevented its further diffusion among the surrounding structures. Although there was great

¹ Medical Communications of the Massachusetts Medical Society, vol. vii., 1845; also Smith on Rupture of the Bladder, in New York Journ. of Med. and Surgery, N. S. vol. vi. p. 364, 1861.

depression at the time of the operation, and the injury was complicated with fracture of the pelvic bones, immediate improvement followed, and the patient made a rapid and complete recovery. The rent was supposed to have existed in the anterior wall of the organ. Six ounces of urine were drawn off, with marked relief, soon after the receipt of the wound.

The practice pursued by Dr. Walker, in the above case, deserves to be imitated whenever we are able to satisfy ourselves that the rupture occupies the anterior and more accessible portions of the bladder. It derives support from what occurs in gunshot wounds, in which, the urine having an opportunity of running off by the abnormal opening as fast as it reaches the organ, severe and fatal infiltration is comparatively rare. It need hardly be added that the sooner the operation is performed, under such circumstances, the more likely will it be to eventuate successfully. The reader will find a number of valuable cases, illustrative of the present topic, in the chapters on wounds and foreign bodies.

Constitutional remedies will be of no avail beyond their power of correcting the secretions and sustaining the sinking energies of life. For these purposes, the usual means are resorted to. In all cases, anodynes are indicated, and they should be administered early and liberally, both to allay pain and to encourage reaction. If the patient survives the first effects of peritonitis, abscesses may form and require opening, just as in infiltration of urine from rupture of the urethra.

SECTION III.

FISTULE OF THE BLADDER.

This affection, as being most commonly a result of external injury, may be appropriately considered under the present division of our subject, although, as will be shown hereafter, it may be induced by other causes, quite diversified in their character, and worthy of attentive study.

A fistule is an abnormal, congenital, or accidental passage, leading from the bladder to some contiguous organ, or from the bladder to the external surface of the body. Hence various appellations are employed to designate such a communication, as vesico-vaginal, vesico-uterine, vesico-rectal, vesico-urethral, and vesico-intestinal. When the fistule succeeds, as it sometimes does, the lateral operation of lithotomy, the term perineal is used. Occasionally there is a

supra-pubic fistule, consequent upon external injury, the high operation for stone, or the supra-pubic puncture of the bladder. A few examples are upon record of the existence of urachal and of vesico-peritoneal fistule. Very recently, I met with a passage of this kind leading from the bladder across the vagina into the rectum, constituting what may be called a vesico-vagino-rectal fistule. Mons. Jobert,¹ of Paris, has lately described a variety of this lesion under the name of vesico-utero-vaginal. All these terms, some of which are not particularly euphonious, have reference, it will be perceived, to the structures involved in the formation of the disease, and may therefore be adopted as the basis of our nomenclature in this particular department of pathology and practice.

Much diversity obtains in respect to the length, form, and direction of these abnormal tracks. Some, as for example the vesico-vaginal and vesico-uterine, are very short, while others, as the vesico-perineal, vesico-crural, and vesico-abdominal, are often several inches in length. Such a passage may be round and narrow, perhaps scarcely capable of admitting a common-sized probe, or broad and irregular, circular, oval, or angular. Occasionally, as in the vesico-vaginal septum, it presents itself in the form of a slit, rent, or fissure. In its direction it may be straight, curved, and even very tortuous.

The number of these passages varies; in general, there is only one, but there may be two, and even more. The lesion may occur alone, or it may coexist with other affections; thus, there may be a vesico-vaginal and a vesico-uterine fistule in the same person, though such a union is extremely rare. There is commonly but one internal and one external orifice.

Every track of this description is lined, when fully formed, by an adventitious mucous membrane, a species of counterfeit of the natural tissue, which, while it protects the surrounding parts from the infiltration of urine, greatly promotes the passage of that fluid from the bladder. The membrane, in recent cases, is soft and imperfectly organized, while in those of long standing it is often of a dense, fibrous consistence. The structures around the fistule may be perfectly natural, but in general, and especially when the disease is the result of sloughing, it is hard and callous, grating under and offering great resistance to the knife. Under such circumstances, too, there is often a remarkably reproductive tendency to induration in the

¹ *Traité des Fistules Vesico-uterines, &c.*, p. 56. Paris, 1852.

parts similar to what is so frequently witnessed in the cicatrice of burns and scalds, and in mercurial sores about the face and lips.

Having made these general remarks, which are intended for the benefit of the student rather than for that of the advanced practitioner, I shall proceed to speak of individual fistules, premising that I shall confine myself to the consideration of a few of the more frequent, loathsome, and important.

ART. I.—VESICO-VAGINAL FISTULE.

A vesico-vaginal fistule is an opening between the bladder and vagina, attended with a discharge of urine through the latter organ. The lesion, which, in consequence of this infirmity, is one of the most deplorable that can befall a human creature, is well calculated to elicit our sympathy and to attract the attention of the surgeon. It is not surprising, therefore, that a great deal should have been written upon it, and that various operations should have been devised for its relief. Its real nature is well understood; but its treatment, unfortunately, will always be environed with difficulties, and, in some cases, even with impossibilities. Comparatively few cases of complete cures have hitherto occurred in the hands even of the most skilful and accomplished operators.

A fistule of this kind is occasionally, though rarely, *congenital*. A case is related in the fifty-sixth volume of the *Dictionnaire des Sciences Médicales*, in which, while the labia, nymphæ, and clitoris were all well developed, there was an absence of the urethra and the neck of the bladder, the urine passing off constantly by the vagina through an opening in the vesico-vaginal septum large enough to admit the little finger. The abnormal aperture generally occurs along the middle line, and is analogous, in its nature and mode of origin, to cleft-palate, harelip, bifid spine, epispadias, and hypospadias.

The most common *causes* of the accidental form of vesico-vaginal fistule may be thus enumerated: 1. Wounds, incised or lacerated, the result of attempts at criminal abortion; the passage of the child's head during parturition; or falls upon the nates, in which the parts strike against some sharp and projecting body, as a chair, or stick of wood. 2. Violent contusion, eventuating in mortification of the vesico-vaginal septum. This occurrence is exceedingly common, and is generally dependent upon the maladroit use of instruments, or the pressure of the child's head during labor, especially when this has been unusually protracted and the bladder has not been

sufficiently often evacuated. 3. The formation of an abscess, traumatic, erysipelatous, or spontaneous. 4. Ulceration, whether simple, venereal, or malignant. 5. The pressure of a urinary concretion, a pessary, or other foreign body. Quite a number of cases are upon record in which a calculus, after having been for a long time retained in the *bas-fond* of the bladder, has gradually worked its way through the vesico-vaginal septum, and at length escaped through the vagina. J. Cloquet¹ relates an instance in which an ivory pessary, worn by an old woman, had perforated both the bladder and rectum, the extremity which projected into the former organ being incrustated with earthy matter. In cancer of the uterus, nothing is more common than for the urinary bladder and vagina to be laid open by an extension of the malignant action.

Some diversity exists in regard to the seat, size, and shape of the abnormal aperture; circumstances of great importance with reference both to the diagnosis and treatment of this affection. The most common *situation* is at the *bas-fond* of the organ, or a little above the centre of the vagina; but in many cases it is just below the uterus, and sometimes, though rarely, just in front of the commencement of the urethra. The *size* of the opening may not exceed the diameter of a small shot, or it may be so great as to admit a pullet's egg, a small orange, or even a larger object. In its *shape* it is generally somewhat oval or circular, but occasionally it presents itself in the form of a transverse, oblique, or longitudinal rent, slit, or fissure. Its edges are usually well defined, rough, callous, and white, with a slight eversion of the vesical mucous membrane. The induration often extends a considerable distance beyond the fissure, especially when this has been caused by sloughing, and hence it is occasionally no easy matter to pare the edges of such an opening with a view to the introduction of the suture. The vagina in the neighborhood of the aperture may be perfectly sound, or it may be variously altered by disease, according to the nature of the exciting cause of the fistule, the violence of the resulting inflammation, and the acrid character of the discharges. It is extremely rare that there is more than one opening.

A singular eversion of the bladder occasionally takes place in vesico-vaginal fistule, the lining membrane passing across the abnormal aperture so as to form a tumor in the vagina. The protrusion, which is seldom considerable, is generally of so trifling a

¹ Surgical Pathology, translated by Dr. Garlick and Dr. Copperthwaite, p. 180. London, 1832.

nature as not to require any particular treatment. When the artificial opening is unusually large, the whole bladder may project through it, and eventually even protrude at the vulva, as in the remarkable case which was communicated to me in 1852, by the late Professor Howard, of Columbus, Ohio. It occurred in a woman who, during her first labor, five years previously, had received an extensive laceration of the perineum and of the vesico-vaginal septum. Four years afterwards, she gave birth to another child, and some months after that event she observed, for the first time, a tumor in the vagina. Upon examining the parts, Dr. Howard found that the fundus of the bladder was completely everted, or turned inside out, and that it hung through the vulva, in the form of a red mass, of the volume of a large orange, and of a globular shape, with a rounded and rather narrow pedicle, encircled by the edges of the vesico-vaginal fistule. The orifices of the ureters were seen at its posterior extremity, within the vagina. The surface of the tumor was rough, ulcerated, and of a deep reddish color. The woman was in a most wretched condition; her general health was much impaired, and she was unable to stand erect or to approximate her thighs. The urine dribbled constantly from the vagina, thus adding greatly to her suffering.

Dr. Howard made an attempt to replace the bladder, but signally failed, although the woman was under the full influence of chloroform. She was then kept for a fortnight in the recumbent posture, and reduced by light diet and other means. Another effort was now made to restore the organ, but with no better success. Resolved, if possible, not to be foiled, he next placed her upon a table, and having elevated the pelvis, he introduced Jobert's univalve speculum into the vagina, and pressed back the perineum. An assistant carried the tumor forwards until he was enabled to expose the mouth of the uterus. The operator then grasped the neck of this organ with a long vulsellum, and pulling it forcibly downwards and backwards, brought the fistulous opening directly and perpendicularly before him. The instrument being then confided to an assistant, the vesical tumor was seized with both hands, and, after having been compressed and kneaded for about fifteen minutes, it suddenly returned to its natural position. The operation being completed, a gilded ball pessary was placed into the vagina, to prevent reprotusion. What the ultimate result of this interesting case was, Dr. Howard did not inform me, as ill health disqualified him, soon after he saw me, from attending to the active duties of his profession.

A female affected with vesico-vaginal fistule must necessarily be an object of the deepest commiseration. Incapable of controlling the contents of her bladder, the urine constantly escapes at the vagina, thus soiling her clothes, and giving rise to the most noisome odors, which no amount of cleanliness can entirely prevent. In consequence of this condition, she is rendered unfit for social enjoyment, and is obliged to spend her life in solitude and retirement. But this is not all: the urine, incessantly dribbling away, chafes and frets the parts with which it comes in contact, and thus renders them unfit for the exercise of their appropriate functions. The escape of urine is constant when the opening is situated at the *bas-fond* of the bladder, and is always worse in the erect than in the recumbent posture.

The *diagnosis* of this affection is, in general, sufficiently easy. In most cases, indeed, the escape of the urine by the vagina, instead of through the natural channel, serves at once to point out its true character, whatever may have been the nature of the exciting cause. Its situation, shape, and extent, however, can be determined only by a thorough vaginal examination by means of the speculum. Some practitioners use the bivalve instrument, but I have never found any difficulty with the cylindrical, and have, indeed, always preferred it. During the exploration the woman may lie on her back, or, what is better, rest on her knees and forearms, with the head as dependent as possible and the nates considerably elevated. The instrument, well oiled, is then introduced in the usual manner, a catheter being at the same time inserted into the urethra. In this way every portion of the vagina may be most satisfactorily inspected, and any opening, however small, easily detected. In some instances, the speculum is advantageously replaced by the finger, which is carried about in different directions, along the anterior wall of the tube, until its extremity comes in contact with the naked end of the catheter. When the aperture is very small, a long slender probe should be used instead of the latter instrument.

The *prognosis* of vesico-vaginal fistule is, in general, anything but flattering. If a spontaneous cure do occasionally occur, the circumstance is so infrequent that it must always be regarded merely as an exception to one of the most uniform laws of the animal economy. The probability of such an event will be considerably greater, other things being equal, when the accident has been produced by a simple wound than when it has been caused by a severe contusion, followed by a slough, when the opening is small than when it is large, and

when the lesion is simple than when it is complicated with other affections. The presence of malignant disease, of course, forbids the hope even of temporary relief by any operation whatever. Nothing but the most determined perseverance and the application of the greatest skill will be likely, even in the more simple forms of the lesion, to eventuate in a complete and permanent cure.

The *treatment* of vesico-vaginal fistule has generally been divided into palliative and radical; the former consisting, as the term strictly implies, in the employment of such means as are calculated to promote the patient's temporary comfort, and the latter of such measures as are designed to effect the obliteration of the abnormal aperture.

It need hardly be said that the sooner such a disease is taken in hand the greater will be the probability of its spontaneous disappearance. This is especially true of the more simple forms of the lesion, such, for example, as are produced by external injury or the maladroit use of instruments. When the loss of substance is considerable, or dependent upon mortification, the chances are that nature will be incompetent to effect a cure without the aid of surgery. Still, even here, much may be accomplished by judicious means, on the principle that, if the whole cannot be obliterated, a part may. For this purpose the patient should observe the strictest recumbency, the strictest cleanliness, and the strictest attention to her diet and bowels. Lying upon her back, with one of Sims's self-retaining catheters in the bladder, will place the fistule in the best possible condition for the adhesion of its edges, the urine being thus permitted to drain off as fast as it descends from the kidneys; while at the same time any undue inflammation of the vagina and neighboring parts may be effectually prevented by cold applications, cold water injections, and, in severe cases, by the application of leeches. Any unpleasant fetor that may arise is to be allayed by weak solutions of chloride of soda. Cohesion of the walls of the vagina is to be carefully guarded against, and may generally be prevented by the treatment just mentioned, aided, if need be, by the use of the tent, properly anointed, and retained by a T-bandage. The treatment is not to be laid aside too soon, but should be persevered in for weeks, or until there is reason to believe that it is incapable of conferring further benefit.

When the case is hopeless, or the patient refuses to submit to the employment of means calculated to produce a radical cure, it is plainly the duty of her attendant to make her as comfortable as possible. Frequent ablutions and injections with cold water, either

simple or medicated, and the occasional use of chloride of soda, will prevent excoriations and noisome fetor, and a proper regulation of the diet, with a soluble condition of the bowels, will go far in preserving the general health, which, under opposite circumstances, sometimes suffers most severely, the patient becoming nervous, dyspeptic, and even hysterical. To guard against the incessant escape of urine, and enable the poor patient to exercise occasionally in the open air, it has been proposed that the vagina should be kept constantly filled with a hollow plug, or caoutchouc bottle, enveloped in oiled silk, and furnished with a tube and stopcock, in order that it may be inflated or emptied at pleasure. Mr. S. Barnes,¹ of Exeter, England, employed, in one instance, with great advantage, a kind of fenestrated bottle, which, when inserted in the vagina, presented the opening to the orifice of the fistule. The opening was occupied by a piece of sponge, which received the urine, and allowed it to filter into the outer receptacle. The patient removed the apparatus herself, whenever it required to be emptied and cleaned. In this manner, with the use of other adjuvants, a certain degree of comfort may be obtained, and life rendered comparatively supportable.

The permanent and *radical* cure of vesico-vaginal fistule may be effected by cauterization and suture, both of which have long been used for the accomplishment of this end. When these means are inapplicable, or fail to answer the purpose, as, unfortunately, they too frequently do, it has been proposed to relieve the patient by closing the vagina. The suggestion had its origin with Mona. Vidal, of Paris, but has seldom, if ever, been carried into effect, owing to the difficulty of producing the requisite amount of cohesion of the mucous surfaces, and the obstacle which such a plan, if successful, would necessarily oppose to the evacuation of the menstrual fluid. In a case under my care, both the vagina and the urethra were obliterated in their entire extent, and all the urine was discharged by the anus, which, as a natural consequence, was in a state of constant irritation. By restoring the passage of the urethra, as I easily did by means of a trocar and a self-retaining catheter, the urine ceased to pass into the bowel, and the woman recovered perfect control over her bladder. The cure was rapid and most satisfactory.

When it is desired to *close the vagina*, or effect its complete obliteration, which, however, can seldom be done, the best plan will be to employ some caustic substance, as the acid nitrate of mercury,

¹ Medico-Chir. Trans. of London, vol. vi. p. 588.

caustic potash, or nitric acid, aided by recumbency and perfect approximation of the thighs. When the object is simply to unite the tube at its inferior extremity, the knife and interrupted suture may be advantageously used instead of caustics or escharotics. In either case, a catheter should be constantly maintained in the bladder to carry off the urine as fast as it reaches that organ, otherwise adhesive action will be sure to be interfered with, if not entirely prevented.

Cauterization of the edges of the fistule is applicable, as a general rule, only in cases of recent standing, and where the opening is very small. Under such circumstances, complete and permanent cures have occasionally been effected, but the remedy requires frequent repetition and the utmost perseverance to insure success. The best caustic is the acid nitrate of mercury, with which the edges of the abnormal opening should be gently but effectually touched, at first, once every four or five days, and afterwards once a week, ten days, or a fortnight, according to the effect of the treatment. The object should be not to produce a slough, but to excite the granulating process, by which the chasm, in favorable cases, will ultimately be filled up. The application should be made with the greatest care, by means of a mop, as a small rag tied to the end of a suitable probe, and the parts should always be thoroughly protected with the speculum. In very recent cases, the desired end might be obtained by the solid nitrate of silver.

The *actual cautery* is, I think, in most cases, suitable for cauterization, preferable to the potential cautery; but the application requires to be made with great care, otherwise mischief instead of benefit will be sure to be the consequence. The parts being thoroughly dried and protected with a fenestrated, wooden speculum, a small iron, warmed to a gray heat, is rapidly passed over the edges of the fissure, the operation being repeated once every two, three, or four weeks, according to the progress of the cure, until the desired object has been attained. Loss of substance is not wished for, but avoided; obliteration being effected by the granulating process.

Incision has occasionally been employed successfully. The operation is, of course, applicable only when the cleft occupies the neck of the bladder, and is unattended with any material loss of substance. Under such circumstances, a cure has sometimes been effected by dividing the urethra through its entire extent from before backwards, and then treating the parts as in ordinary fistule. The late

Mr. Blundell, of London, and Mr. Porter, of Dublin, each succeeded in relieving a case in this manner.¹

Before formally speaking of the suture, a most prolific and extensive topic, I may refer here to a novel and ingenious operation, proposed, a number of years ago, by Mons. Velpeau, but first practised by Mons. Jobert. It is designated by the term *elythroplastic*, and simply consists in covering the fistule by means of a flap of integument borrowed from one of the great lips, and carefully retained by suture; the old connection being preserved until the new is pretty firmly established. Of four patients thus treated by Jobert, one was cured immediately, and another by a second operation; one died, and one was unrelieved. No surgeon, however experienced or skilful, could, it seems to me, promise himself much from such an expedient, which is more ingenious than practicable.

The method by *suture*, although environed with difficulties, and subject to frequent failure, is far preferable to any other, and should, therefore, be studied with great care and attention. Its origin is generally, and perhaps correctly enough, ascribed to the celebrated Dutch surgeon, Roonhuyze, who flourished in the seventeenth century, and acquired much distinction in the treatment of the diseases of the genito-urinary organs. It does not comport with the scope of this work to enter into a history of this plan of treatment, or to speak of the various modifications which it has undergone in the hands of different practitioners; suffice it to say, that it has frequently been successfully employed in the Old as well as in the New World, and that it is justly entitled to be ranked among the established operations of surgery. I am not able to state by whom it was first adopted in this country; but the flattering results that have followed it in the hands of Dr. Heyward, of Boston, Dr. Mettauer, of Virginia, Dr. Pancoast, of Philadelphia, and Dr. Sims, of New York, to say nothing of others, are well known, and reflect great credit upon those gentlemen. The operation, as improved by the latter, based as it is upon numerous trials, and the invention of highly ingenious instruments, is deserving of the greatest praise, and justly entitles that distinguished surgeon to the thanks of the profession, and the gratitude of the class of sufferers for whose benefit it has been devised.

Before any operation of this kind is undertaken, I deem it to be a matter of great consequence to subject the patient to a certain amount of preliminary treatment. Without this precaution, failure,

¹ Churchill on the Diseases of Females, p. 585. Philada. 1843.

not success, will be likely to attend our efforts. The treatment need not be protracted, but it should be thorough, both as it respects the parts and the system at large. The most absolute recumbency and cleanliness should be observed; the vagina should be frequently syringed with cold water; cold cloths should be kept constantly upon the vulva; the bowels and secretions should be properly regulated; the diet should be perfectly plain and simple; and large quantities of demulcent drinks should be used to dilute the renal secretion, and deprive it of its acrimony. If the woman be plethoric, blood should be taken from the arm, or from the vulva, perineum, groins, and thighs, by means of leeches. Thus prepared, she will be able to bear the operation with greater impunity, and with a better prospect of a favorable issue.

In performing the operation, according to the methods commonly in vogue, the patient, after being thoroughly influenced by chloroform, is placed upon her back, as in the operation of lithotomy, the limbs being elevated and held apart by assistants. The vagina is then opened as widely as possible by means of blunt hooks, with stout handles, and a large silver male catheter with a long curve is inserted into the bladder, the handle inclining slightly forward over the pubes. In this way the fistule is readily brought into view, and an opportunity afforded for paring its edges, which should always be done in the most thorough manner, every particle of indurated matter being removed as an essential preliminary. A common tenaculum, and a sharp-pointed, narrow-bladed bistoury, either alone, or aided by a pair of long, slender, sharp-pointed scissors, are the best instruments for performing this part of the operation. The bleeding having ceased, and the blood being carefully wiped away with whalebone mops, the edges are approximated by means of a particular needle, of which one of the most eligible is that represented in Fig. 46. The threads, composed of well waxed saddler's silk, are introduced at least a third of an inch from the wound, in order to secure a firm hold, none being tied until they have all been properly arranged. A reef-knot having been made, the ends are cut off close, lest they should afterwards interfere with the cleansing and inspection of the parts. The sutures are not removed, on an average, until about the tenth day, and in doubtful cases they should be retained a longer period.

The *operation of Dr. Sims*, which is destined, if I mistake not, to supersede every other form of suture, is sufficiently simple and easy, although, from the numerous instruments required for its execution,

it appears, at first sight, to be somewhat complicated. The nature and objects of these instruments will be rendered evident by the description of the different stages of the operation and by the accompanying illustrations.

In performing the operation, the first thing to be attended to is to obtain a full and ready view of the affected parts. For this purpose, the patient is placed upon a stout and rather narrow table, or, what I have found more convenient, upon a firm lounge, on her knees and forearms, with the nates elevated, and the head and shoulders

depressed. The thighs, separated about eight inches from each other, should form a right angle with the table, and the clothing should be so light and loose as to take off all pressure from the abdomen and its contents, which will thus tend to gravitate towards the epigastric region. An assistant on each side lays a hand in the fold between the gluteal muscles and the thigh, the ends of the fingers resting upon the great lips. The nates being now simultaneously pulled upwards and outwards, the air rushes into the vagina, widely dilating it, and so affording an easy view of the fistule, as well as of the mouth of the uterus. The exhibition will be rendered still more perfect if the assistant standing on the right of the patient inserts the elevator-speculum, represented in Fig. 42, and raises the perineum, the sphincter muscle of the anus, and the recto-vaginal septum. The instrument, when properly

applied, causes no pain, and as

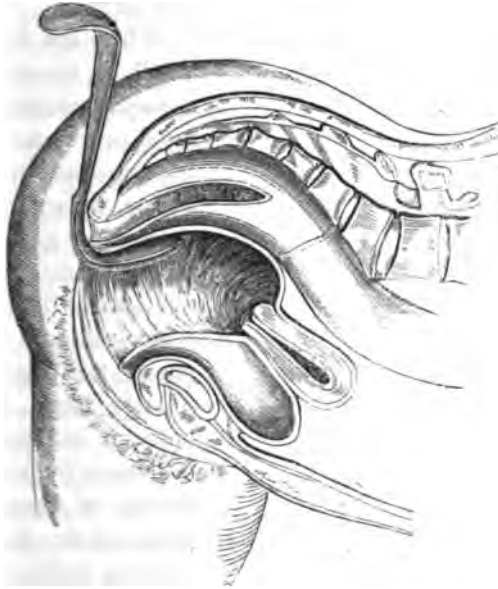


Sims's Elevator Speculum. *c, c.* Concavity. *f.* Cushioned handle. Distance from *a* to *b* 2½ inches; from *d* to *e* ¾ths of an inch.

its posterior surface is concave and highly polished, it serves to reflect a strong light down the passage. It is well enough to have several sizes, so as to be prepared for any case that may arise. The

one usually employed by Dr. Sims is made of German silver, and has a vaginal curve two inches and a half in length by nearly one inch in width, with a very strong and unyielding handle, the bend being cushioned to protect the forefinger as it lies over it during the operation. Fig. 43 shows the application of the instrument, the

Fig. 43.

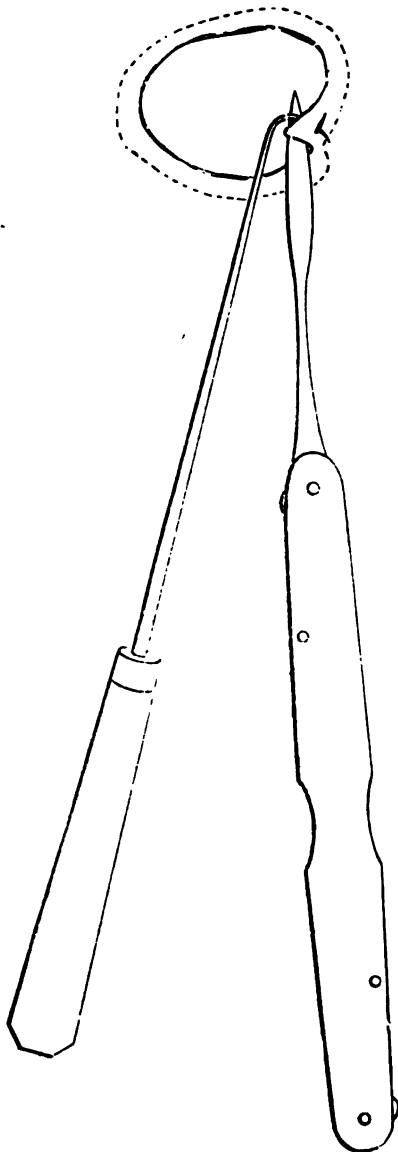


position of the thigh and nates, the appearance of the dilated vagina, and the situation of the uterus, the bladder, and vesico-vaginal septum. In addition to the precautions already described, it is necessary to have a strong northern light; but when this is not sufficient, a small mirror may be used, the reflection of which will generally make everything perfectly distinct, and enable the operator to proceed without any embarrassment from this cause.

The *second stage* of the operation consists in paring the edges of the fissure, for which purpose it is necessary to have at hand a *tenaculum* and a sharp-pointed bistoury, quite narrow in the blade, and provided with a stout, firm handle. The manner of using these instruments will be readily understood by an examination of the accompanying sketch (Fig. 44). The amount of substance removed must depend upon the degree of induration, but, in general, it should not be less than a quarter of an inch. As in the operation

for harelip, the surgeon is more apt to cut too sparingly than too freely. The lining membrane of the bladder is never interfered

Fig. 44.



with, unless, as sometimes, though rarely, happens, it projects through the fistule into the vagina in such a manner as to embarrass our proceedings.

When the fistule is very small, as, for instance, when it hardly admits an ordinary sized probe, the edges should be transfixed with the tenaculum, drawn forwards, and excised by a circular sweep of the knife, carried through the entire thickness of the vesico-vaginal septum. In paring the edges of an unusually large opening, the operator is sometimes embarrassed by the protrusion of folds of the mucous membrane of the bladder, which are thus liable to be injured by the knife. Should such an event arise, a catheter should be immediately inserted into the urethra, and pressed gently against the fundus of the bladder, which, by putting the parts on the stretch, will promptly efface the redundant folds.

In paring the edges of the fistule, there must necessarily be some bleeding, though this is seldom sufficient to cause any embarrassment or serious

delay. The best contrivance for wiping away the blood—and this should always be done by the surgeon himself—is a small probang,

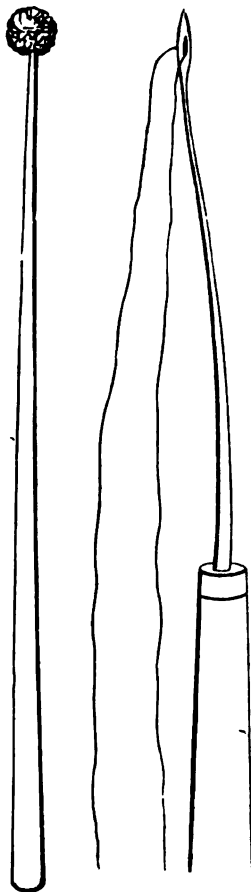
(Fig. 45), made by tying a bit of soft sponge to the extremity of a piece of whalebone, about nine inches long. It is always well to have at hand several instruments of this description, as they require to be frequently used during this and the subsequent steps of the operation.

In the *third stage* of the operation, the surgeon introduces the necessary sutures. The one which Dr. Sims prefers, and of which, indeed, he is the inventor, is the clamp suture, as he terms it. It is a modification, but a very important one, of the old quilled suture, being composed of small annealed silver wire, not thicker than a horsehair, and of two cylindrical cross-bars, each about a line in diameter. These pieces, which, when applied, act on the principle of the clamp, are made either of silver or lead, as may be most convenient, being tubular in the former case and solid in the latter; they must be highly polished, and without the slightest asperity, especially at their extremities. Their length, like the number of sutures, must depend upon the size of the abnormal opening.

The annexed drawing, Fig. 46, represents the needle used for passing the sutures. It is about six inches long in the shaft, malleable near the handle, to admit of its being bent into any desirable shape during the operation, awl-like in its form, and spear-pointed, with the eye near the extremity. As a preliminary step, three silk ligatures are introduced, the middle one being placed first, and then each lateral one, the needle being entered about one-third of an inch from the lower edge of the fissure, and brought out at a corresponding distance from the upper. The transfixion of the inferior lip is easy enough, but that of the superior is generally difficult on account of the mobility of the part, which should therefore always be supported with a blunt-hook, such as that represented in Fig. 47, the point of which is placed

Fig. 45.

Fig. 46.



flatwise just beyond the spot at which the needle is expected to emerge. The same instrument, or an ordinary tenaculum, may be used for disengaging the short end of the thread after the transfixion has been completed. Fig. 48 exhibits the arrangement of the ligatures after they have been introduced, the fistule with its raw edges, and the punctures made by the passage of the needle.

A piece of silver wire, from twelve to eighteen inches in length, is now secured to the upper extremity of each ligature, as seen in Fig. 49, and carried across the wound, as the thread whose place it

Fig. 47.

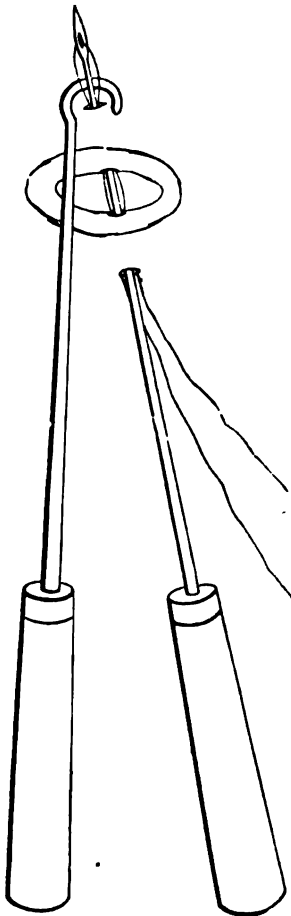


Fig. 48.

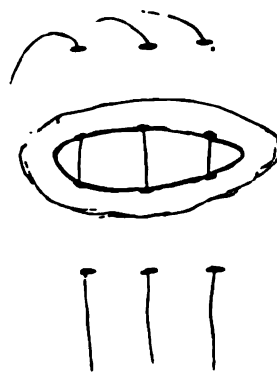
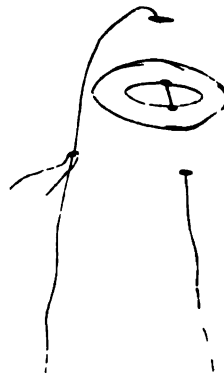


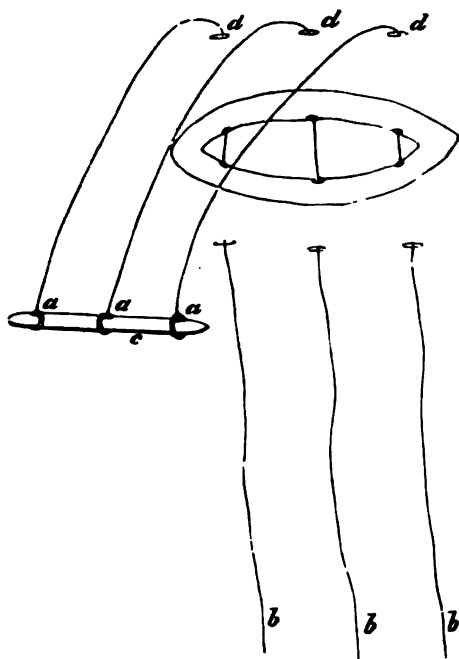
Fig. 49.



is intended to occupy is withdrawn. "The next step is to secure them by means of the clamps. In Fig. 50, the wires are represented

as passed, the ends of each being brought out of the vulva; the distal; *a, a, a*, to the left; the proximal, *b, b, b*, to the right. The distal

Fig. 50.



ends are passed through small oblong holes made in the silver or leaden bar *c*, to suit the distances between the points of suture at *d, d, d*. The wires may be fastened to the bar or clamp *c*, by being turned twice around it, or by being passed through a perforated shot and bent over it. This done, we now pull upon the proximal ends, *b, b, b*, and, as a matter of course, the bar *c* is carried into the vagina, up above the fistule, and made to occupy a bed right over the orifices *d, d, d*. . . . The next step is to pass another bar or clamp on the proximal ends of the wires, and to push it along them into the vagina, till it occupies a position in front of the fistule, corresponding exactly with the one behind it."

Fig. 51 represents the clamps in their relation with the wires and the fistule. To approximate the denuded edges of the opening, all that is necessary is to push up the inferior rod, and to secure it in its place by compressing the shot over the wires by means of a strong pair of forceps. The shot are thus made to perform the office

of so many knots, by which the clamps are effectually prevented from slipping. The contact of the parts should be gentle but perfect, without the slightest tension on the one hand, or the least laxness on the other. The operation, which need not occupy more than thirty minutes, is completed by cutting off the ends of the wires within the eighth of an inch of the shot, and bending them slightly upon themselves. The self-retaining catheter (Fig. 52) being inserted into the urethra, the patient is put in bed, and treated on general antiphlogistic principles.

Fig. 51.

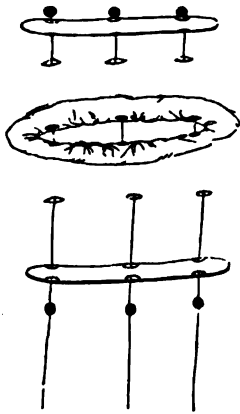


Fig. 52.

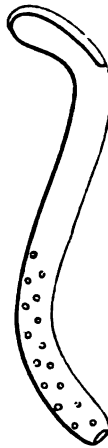
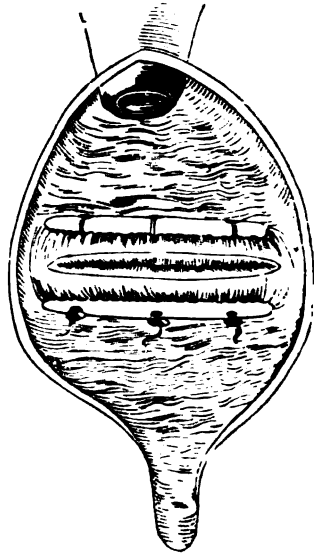


Fig. 53.



The adjoining cut (Fig. 53) exhibits the appearance of the fistule and suture after the operation, the position of the denuded edges, the situation of the clamps, and the arrangement of the ends of the wires and shot.

Much of the success of this operation, and, indeed, every other of a similar kind, will depend upon the *after-treatment*. As soon as the patient is put to bed, she should take a large anodyne, for the twofold purpose of allaying pain and inducing quiescence of the bowels, which, in no case, should be disturbed under ten, twelve, or fifteen days. The diet should consist exclusively of tea and crackers, or of coffee and crackers, with water as the common drink. Opium is given twice a day in as large doses as can be

borne, and the patient is never permitted, even for a moment, or for any purpose whatever, to assume the erect posture, though she may if she prefer it lie on either side. The catheter is to be removed as often as may be necessary to keep it clear of mucus and calculous matter; once a day, once every other day, or once every third day, according to the circumstances of each individual case. The vulva and orifice of the vagina should be syringed at least twice in the twenty-four hours with cold water, a large bed-pan being placed under the nates during each operation to receive the fluid as it runs off. Should undue inflammation arise, leeches and even the lancet should be called into requisition, and that with the least possible delay; purging is still carefully avoided, especially if there be no marked derangement of the digestive organs, and the utmost attention is paid to cleanliness. Both part and system are occasionally endangered by erysipelas. In a patient under my charge last spring, although more than usual care had been bestowed upon the preliminary treatment, a most violent attack of this disease took place within a few days after the operation, commencing on the right buttock, and gradually spreading over the upper part of the thigh, perineum, and vulva, from which it speedily extended into the vagina, causing large deposits of lymph, with a strong disposition to cohesive action. The constitution suffered very much, and at one time I was not without serious apprehension in regard to the ultimate issue of the case. Notwithstanding all this, however, the woman made a good recovery, though several months elapsed before she fully regained her strength. The sutures were not removed until the end of the third week.

Peritonitis has occasionally occurred after this operation, and it is well enough always to have an eye to the possibility of such an event; so that, should it show itself, it may be promptly combated. It will rarely appear before the third day, or after the sixth or eighth.

The sutures should not, as a general rule, be removed before the tenth or twelfth day; if taken off sooner, the adhesions will be apt to give way, and thus necessitate a repetition of the operation. Considerable difficulty is sometimes encountered in separating the clamps, owing to the manner in which they become imbedded in the mucous membrane of the vesico-vaginal septum and the granulations consequent upon the irritation produced by their presence. Occasionally, indeed, they are thus completely concealed from view. The flattened shots being clipped off, the lower rod is lifted from its

bed with a blunt-hook; after which the upper one, along with the attached wires, is seized with a pair of long slender forceps, pushed up, and entirely disengaged. The patient, instead of sitting up or walking about, observes the recumbent posture for several days longer, and the use of the catheter is continued until there is reason to believe that the new cicatrice has acquired sufficient strength to resist the pressure of the distended bladder and the traction of the surrounding parts.

ART. II.—VESICO-UTERINE FISTULE.

Under the name of "vesico-uterine," Professor Jobert,¹ surgeon to the Hôtel-Dieu, at Paris, has recently described a variety of urinary fistule, the first distinct notice of which occurs in Madame Lachapelle's² celebrated treatise on midwifery, published in 1821. In this work, she refers to a case which she observed in her own practice, but of which she gave no detailed history until four years afterwards, on the appearance of the second edition of her book. In 1828, a similar instance was witnessed by Dr. Stoltz,³ of Strasbourg, who made it the subject of an interesting and valuable memoir. For the most complete history of the affection, however, we are indebted to Professor Jobert, who has embodied everything that is known respecting it in the work mentioned below.

The *seat* of this fistule is between the posterior wall of the bladder and the corresponding portion of the neck of the uterus, just above the attachment of the vagina and below the reflection of the peritoneum. The vagina, consequently, is interested only indirectly, serving merely as a recipient of the urine as this fluid descends from the abnormal opening in its outward course. In general, only the anterior wall of the neck of the uterus is implicated; but occasionally, as, for example, in the case observed by Professor Stoltz, a perforation exists also in the posterior wall, thus constituting a double fistule, meriting the name of vesico-uterine and utero-abdominal. In this case, the patient, aged thirty-four, pregnant with her third child, died forty-one days after her delivery, the urine having

¹ *Traité des Fistules Vésico-utérines, Vésico-utéro-vaginales, Entéro-vaginales, et Recto-vaginales.* Paris, 1852.

² *Pratique de l'Art des Accouchements*, t. i. Paris, 1821; *ib.*, Paris, 1825, t. iii. p. 405.

³ *Mémoire sur les Perforations du Col de l'Utérus et les Fistules Vésico-utérines et Vesico-abdominale, à la suite de l'Accouchement.* Strasbourg.

all along escaped by the vagina. The autopsy revealed signs of pulmonary engorgement and of the most intense inflammation of the peritoneum, with numerous abscesses, from the size of a filbert to that of a pullet's egg, upon the uterus, in the broad ligaments, and in the cellular tissue of the pelvis. The bladder was contracted and drawn up behind the pubes. A communication existed between the ~~bas-fond~~ of this organ and the anterior wall of the neck of the uterus, at a distance of six lines from the external orifice; it was of a circular shape, surrounded by a red border, and sufficiently large to admit with facility an ordinary pocket-case probe. Immediately opposite this opening existed another, precisely of the same form and size, which established a communication between the cavity of the neck of the uterus and the peritoneal cul-de-sac between this viscus and the rectum. The parts at this point were covered by a thick false membrane, which had thus prevented the escape of the urine into the abdominal cavity. The substance of the uterus and vagina was sound. The cavity of the pelvis was preternaturally small, and this circumstance was, doubtless, the cause of the tedious labor and of the compression of the womb by the head of the child, eventuating in a slough, and the consequent formation of a fistule.

The vesico-uterine fistule is always very short, and generally of a rounded *form*, particularly when it is the result of a loss of substance. Now and then it is more or less ragged and irregular. It is lined by an adventitious membrane, and has seldom more than one orifice. The parts around the abnormal track are variously altered, the extremity of the uterus being commonly partially destroyed, and the cervical canal red and inflamed.

The *cause* of this affection is injury received during parturition, consisting either in a laceration of the parts, or a severe contusion, terminating in sloughing. This may depend upon the maladroit use of instruments; or, as is more commonly the case, upon the pressure of the child's head, especially when there is a considerable disproportion between it and the straits of the pelvis, thereby rendering the labor unusually difficult and tedious.

The *symptoms* attending this accidental communication are not reliable in a diagnostic point of view, and this is, no doubt, one, if not the principal reason, why this variety of fistule remained so long undescribed. No positive conclusion can be deduced from the escape of the urine by the vagina, because this fluid takes the same route in some of the other forms of the malady; we only know that dribbling is constant during recumbency, and intermittent in the

erect or sitting posture. And this also, let it be borne in mind, is not peculiar to vesico-uterine fistule. It has been proposed to use the speculum, and, holding it over the neck of the uterus, to inject the bladder forcibly with tepid water, the escape of which into the vagina might thus, it is supposed, indicate the site of the abnormal aperture; but even this does not always answer, and cannot, therefore, be implicitly relied upon in all cases. Perhaps the most unexceptionable method that can be adopted is to make the examination with the index finger, and a long probe with an abrupt curve at the extremity, the former being introduced into the vagina, and the latter into the bladder, while the patient is reclining upon her knees and forearms, and the perineum is elevated by Dr. Sims's lever-speculum, depicted on a previous page. In this way any opening, however small, could scarcely fail to be detected.

A vesico-uterine fistule is dangerous or otherwise, according to the presence or absence of other disease. In the case which I have cited from Stoltz, and where the lesion was complicated with what that writer has denominated a vesico-abdominal fistule, it proved fatal at the end of the forty-first day, in consequence of violent peritonitis, attended with the formation of numerous abscesses in the subserous cellular tissue of the womb and pelvis. When the opening is single and the uterus and bladder are otherwise healthy, there will be no probability of such an event, although a permanent cure may not be practicable. Ulceration, softening, and induration always constitute serious complications, which should be duly considered when we are called upon to give an opinion respecting the ultimate issue of any case of this description.

The only surgeon, so far as I know, who has devoted any attention to the *treatment* of this variety of fistule, is Professor Jobert, who, in the work already referred to, has described and delineated an operation which he employed successfully in the only case of the kind to which he has ever applied it. It is extremely difficult of execution on account of the concealed situation of the abnormal opening, and demands the most thorough knowledge of the anatomy of the parts. The incisions must be made with the greatest care and patience, otherwise they might easily extend into the pelvic cavity, and thus induce fatal peritonitis. No caustics are of any avail in the treatment of this fistule.

Mons. Jobert's operation consists of two distinct processes, in one of which an attempt is made to obliterate the opening in the bladder, without touching that in the uterus. It is commenced by dividing,

from one side to the other, the neck of the uterus in the direction of its commissures. The vagina is next carefully dissected up laterally and above, the finger being frequently inserted into the wound, in order to ascertain the situation of the vesical orifice. As soon as this is found, the womb is drawn down towards the vulva with *Musseau's* forceps, where it is held by an assistant, while the edges of the fistule are pared with a bistoury and a pair of strong forceps, both blunt-pointed. The sides of the womb are then approximated by sutures; a catheter is permanently retained in the bladder; and the case is treated upon general antiphlogistic principles.

If the above operation fail, then the surgeon performs another, in which he endeavors to cut off all communication between the vagina and the uterus, by throwing the canal of the latter, as it were, into the cavity of the bladder. The first step consists in dividing the lips of the womb from side to side, in the direction of their commissures, and the second in carefully paring their inner surface from the lower margin of the abnormal aperture downwards. The two raw flaps thus made are then united by three sutures, one corresponding with the centre and the other with each side. They should be placed as low as possible, in order that they may not interfere with the upper portion of the uterine canal, and they should be withdrawn from the sixth to the tenth day. If the operation succeed, the menstrual fluid will pass into the bladder at each monthly period, and the urine will cease to be discharged by the vagina.

ART. III.—VESICO-UTERO-VAGINAL FISTULE.

In this variety of fistule there is, as the name implies, perforation both of the bladder, the uterus, and the vagina. It is a more frequent, as well as a more serious occurrence than the vesico-uterine form of the affection, but it is induced by the same causes, and requires similar but somewhat modified operations for its relief. It was first noticed by *Mons. Jobert*, who has given a very good description of it in the work already cited, accompanied by several illustrative drawings and cases.

The extent to which the vagina suffers in this species of fistule is sometimes very great. Thus, the anterior wall of the tube may be destroyed from one extremity to the other, leaving an opening which readily admits the hand into the bladder. The parts which remain are indurated, and marked by scars and ridges which contrast strikingly with the mucous membrane in its healthy state. The fistulous

opening is sometimes surrounded by shreds and folds of the vagina. The bladder is always seriously affected, but the disorganization is ordinarily limited to that portion of the organ which corresponds to the vesico-vaginal septum and the neck of the uterus. It may be displaced so as to form a hernia across the abnormal opening, but more commonly it is retained in its position by morbid adhesions. The neck of the womb is sometimes partially, at other times completely, destroyed, leaving, perhaps, merely a little tubercle at one point of the circumference of the fistule.

When the loss of substance is so great, as it usually is, in this form of fistule, there can, in general, be no difficulty in recognizing the nature of the disease. A careful examination with the speculum, while the patient rests upon her knees and elbows, will be sufficient to disclose the whole extent of the mischief, and enable us to distinguish it from all other forms of the affection. The discharge of urine is constant; there is also, whatever may be the patient's posture, a more or less abundant flow of muco-purulent matter, and the parts are unusually painful and excoriated. The general health is deteriorated, and the mind is peevish, fretful, and despondent.

To remedy such a deformity as that above described, requires no ordinary trouble, and often baffles the best directed efforts of the surgeon. Nevertheless, Mons. Jobert has cured three patients out of four, subjected to operation. In the unsuccessful case, death was produced by peritonitis on the fifth day.

The *operation* devised by this surgeon for the relief of this accident is founded upon the same principles as the one already described in connection with vesico-uterine fistule: consisting, like it, of two distinct processes. In the first, the vagina is separated from its attachments to the neck of the uterus, and, by means of incisions, carried obliquely through its sides, above and below, the tube is loosened so as to enable the lips of the fistule to come together. In the next place, the surgeon pares the remnants of the vesico-vaginal septum and of the neck of the uterus; and, lastly, the raw surfaces are approximated by several sutures, introduced in such a manner as to embrace the septum and a considerable portion of the thickness of the neck of the womb. Any undue tension of the parts is relieved by the knife; and the stitches are withdrawn on the fifth or sixth day. If this operation should not succeed, then an attempt is to be made to throw the uterine and vesical cavities into one, by shutting off all communication between the former and the vagina, as in the second process for the relief of vesico-uterine fistule. When the

union has been completed, the uterine tubercle will present the appearance of a kind of flap, which closes the accidental opening like a lid; the neck of the organ, in fact, performing the same office as the sole in partial amputations of the foot.

ART. IV.—VESICO-VAGINO-RECTAL FISTULE.

Under this denomination may be briefly mentioned a variety of fistule, which, although it has, doubtless, occurred in the hands of other practitioners, has never, so far as I know, been described. I have seen but one example of it, and that, unfortunately, could not be examined as critically as could have been desired. In this form of the affection, the abnormal opening extends, as the phrase denotes, from the bladder through the vagina to the rectum, the urine passing off by the anus.

The only case in which I have noticed this variety of fistule was that of a negress, named Judiana, aged twenty-seven, a resident of Princeton, Kentucky. In April, 1851, she was delivered, under the care of an ignorant midwife, of an uncommonly large child, after a severe labor which lasted an entire week, and during which the urine was obliged to be drawn off several times with the catheter. For the first three days, however, after the labor commenced, the bladder was permitted to remain distended, and it was probably during this period that the mischief took place. It is proper to state that no instruments were employed, although the child had an unusually large head. The labor was succeeded by violent vaginitis, with fever and delirium, on recovering from which, at the end of a few days, the woman was unable to pass a drop of urine by the natural channel. The inflammation gradually subsided, but not before it had produced complete obliteration of the vagina and the urethra. The general health was much impaired, and many months elapsed before it was completely re-established. For a long time, she was exposed to great and frequent suffering, characterized by violent pain and tenesmus, from distension of the bladder, in consequence of the inability of the organ to relieve itself properly of its contents through the abnormal passage. For the first ten or twelve months after the accident, the urine dribbled off constantly by the anus, but after that period, she was able to retain it for half an hour, or even a whole hour, at a time, especially when in the erect posture. When lying down, or sitting up with the head reclining backwards, she had less control over it. The rectum, which thus served the

purpose of a sort of accessory reservoir for the urine, was unusually tender and irritable, and the anus constantly exhibited an inflamed and excoriated appearance. Fifteen months elapsed from the time of the accident until the re-establishment of menstruation; since then it has always recurred with great regularity, though rather sparingly, at every lunar month, generally lasting about three days, and usually attended by more or less pain in the back and pelvic region. The catamenial fluid is of the natural color, and has, ever since the formation of the fistule, been discharged by the anus. The urethra presented nothing peculiar at its orifice, but all attempts to pass an instrument, even the smallest pocket-probe, proved abortive. The obliteration, in truth, was complete.

Early in July, 1854, my colleague, Professor Miller, into whose hands the patient had been first placed on her arrival in the city, made an attempt to restore the obliterated vagina, but after having passed along for a distance of about an inch and a half, he was obliged to desist for fear of inflicting serious mischief. Some time afterwards, I made a similar but equally unsuccessful effort. Subsequently, with the aid of Professor Miller, I introduced a large curved trocar into the urethra, for the purpose of re-establishing the natural channel for the urine. The operation was performed without difficulty, the woman being under the influence of chloroform, and a self-retaining catheter was immediately inserted into the bladder. By wearing this, off and on, for several weeks, the passage has been completely restored to its former size, and the urine is now discharged in as full a stream as ever, and that not oftener than five or six times in the twenty-four hours. The fact is, she has the most thorough control over the bladder, the general health is excellent, and not a drop of fluid is discharged by the anus.

Since the restoration of the urethra, the girl has menstruated but once, the fluid being voided, as she supposed, by the bladder, and not, as formerly, by the rectum.

ART. V.—VESICO-RECTAL FISTULE.

The term vesico-rectal sufficiently explains itself. The lesion may be produced by numerous causes, of which the most pregnant are incised, punctured, and gunshot wounds, ulceration, abscess, and the existence of malignant disease, whether in the bladder or in the rectum. A calculus, permanently arrested behind the prostate

gland, may, by its pressure, induce perforation of the vesico-rectal septum, and so occasion the affection in question.

The characteristic *sign* of this variety of fistule is the interchange of the contents of the two contiguous reservoirs, the urine passing into the bowel and the feces into the bladder. In consequence of this occurrence, the parts are apt to become sore and irritable from the contact of substances which are entirely foreign, and, therefore, injurious to them. Moreover, the constant introduction of fecal and other matter into the bladder is liable to give rise to calculous concretions and to retention of urine. Effects similar to these may result from a fistulous communication between the bladder and the ileum or the bladder and the colon; doubt may also arise, under such circumstances, as to the actual location of the opening. When this is the case, a careful examination with the anal speculum, aided with a slender catheter, very conical at the point, will generally enable us to arrive at a correct decision respecting the real nature of the lesion.

Vesico-rectal fistule, however induced, will often disappear of its own accord. In all cases, the greatest attention should be paid to the rectum, which should be kept constantly free from fecal matter, the ingress of which into the bladder is a source of so much mischief and suffering. For this purpose, especially in the traumatic form of the lesion, the bowels should be maintained, for days together, in a perfectly quiescent state by morphia, opium, or laudanum, and the rectum should be washed out several times in the twenty-four hours with cold water, or, if the discharges be fetid, with a very weak solution of chlorinate of soda. The recumbent posture should be carefully observed; the diet should be of the most bland and simple character; and drinks of every description should be used as sparingly as possible. As the case progresses, the closure of the fistule may often be greatly promoted by the constant retention of the catheter, which thus conducts off the urine as fast as it reaches the bladder, and of course prevents it from passing into the bowel.

When nature fails to accomplish her purpose, a cure may not unfrequently be effected by the use of nitrate of silver, acid nitrate of mercury, or the actual cautery, applied through the intervention of an anal speculum. In very obstinate cases, especially when the abnormal opening is situated very low down, the edges may be pared, and united by suture, as in vesico-vaginal fistule; the parts being previously dilated by the bougie, and widely opened at the

time of the operation by means of blunt hooks. When this proceeding does not afford the requisite room, it would be perfectly proper to divide, as a preliminary step, the sphincter muscle.

When the fistule has been caused by the operation of lithotomy, it will generally close spontaneously, but should it fail so to do, I would hesitate a good deal before I would divide the parts, as has been recommended by different surgeons. The worst forms usually of this accident are those which follow the recto-vesical section, and here the knife may occasionally be used with advantage.

ART. VI.—VESICO-URACHAL FISTULE.

The urachus, which connects the summit of the bladder to the anterior wall of the abdomen, and which is the vestige of an important foetal structure, now and then remains pervious, and allows the urine to escape at the umbilicus. The affection is generally congenital, but occasionally it arises after birth, either in consequence of some mechanical obstruction in the urethra, or from some diseased condition in the superior portion of the bladder. A remarkable case, in which an open urachus contained a ring-shaped calculus formed on a curved hair, is briefly narrated in the introduction. The opening, which was associated with umbilical hernia, had existed from birth; the man could retain a pint of urine at a time, and was forty-five years old when he submitted to the operation for the removal of the concretion.

The umbilical *orifice* is usually quite narrow, and surrounded by a fungous border, formed of pale, unhealthy granulations, giving the part the appearance of a small tumor, or wart-like excrescence. In some instances, as in the case above alluded to, an instrument can be readily passed from the urethra, across the bladder, through the abnormal orifice. The parts around the opening experience the same fate from the contact of the urine as in the other varieties of the lesion, already described.

The *treatment* of this variety of fistule is sufficiently simple. In general, it is only necessary to remove the exciting cause to enable the abnormal opening to close and cicatrize. Whenever there is any urethral obstruction, this should, therefore, always be remedied as a preliminary measure. In obstinate cases, the edges of the fistulous orifice should be cauterized or pared, in the same manner as in the other forms of the disease.

ART. VII.—URETHRO-VAGINAL FISTULE.

In this form of the complaint, the fissure exists in the urethro-vaginal septum, generally at its posterior extremity, and consequently near the neck of the bladder. The accident, which, on the whole, is unfrequent, is generally caused by the imprudent use of instruments, either during parturition, or in operations upon the bladder. It may also be produced by external injury, properly so called, as a fall, blow, or kick upon the part, and by ulceration from the irritation of a calculus or other foreign body.

The abnormal opening is of variable dimensions, and may present itself in different *forms*; sometimes as a mere slit, and at other times as a distinct hole, directed transversely, obliquely, or even longitudinally. The parts around may be perfectly natural, or, as more commonly happens, they may be indurated, rugose, ulcerated, and more or less excoriated. It is rarely that the fistule is double, or that it coexists with any of the varieties of form described in the preceding articles.

In general, the same disagreeable *symptoms* and inconveniences attend this as the other varieties of vesical communications. There is, however, usually less dribbling of urine, and, if the opening be situated near the anterior extremity of the urethra, the patient may even enjoy the power of retention, though such an event is hardly to be expected under ordinary circumstances. When any doubt exists respecting the character of the case, a careful examination with the finger and probe, or the probe and speculum, will at once dispel it.

The *treatment* of this variety of fistule must be conducted according to the general principles laid down in regard to the management of the other forms of the malady. In simple and recent cases, a cure may occasionally be effected by cauterization with the nitrate of silver, sulphate of copper, acid nitrate of mercury, or the hot iron. A good plan sometimes is to lay open the urethra in its whole length, from the external orifice to the abnormal aperture, and then healing it up, as it were, from the bottom, as is done in ordinary fistule. The most reliable method, however, is the suture, the edges of the rent being previously pared, as in the other forms of the disease, and a catheter being retained in the bladder until the consolidation is completed. Operations of this kind are more easy of execution, and more frequently successful, than in vesico-vaginal fistule.

CHAPTER III.

INFLAMMATION OF THE BLADDER.

SECTION I.

GENERAL OBSERVATIONS.

INFLAMMATION of the bladder, technically termed cystitis, generally begins in the mucous membrane, and presents itself under two varieties of form, the acute and the chronic. Of these, the first is exceedingly infrequent; a circumstance the more surprising when we consider the heterogeneous nature of the urine, and the great variety of changes to which this fluid is subject from food, drink, medicine, and disease. In the course of an extensive practice during the last twenty-five years, comparatively few cases of this complaint have fallen under my observation; nor has this organ, in the numerous dissections which I have made within that period, exhibited, except in a few instances, evidences of this affection. Dr. Louis, of Paris, examined the mucous membrane of the bladder in five hundred subjects, dead of various diseases, without discovering any serious lesion in any of them. In six there was simple redness or injection of the vessels, but no change of structure; in a few only was there any softening and organic derangement. Similar testimony in regard to the infrequency of acute inflammation of the bladder, is borne by Brodie, Hope, Begin, Coulson, and other writers on the diseases of the urinary apparatus. The chronic form of the malady, on the contrary, is sufficiently common, and often entails a vast amount of suffering, which, continuing for months, and perhaps years, finally saps the foundations of life, and brings the patient to a premature grave.

Acute inflammation rarely occupies the whole of the mucous surface of the bladder; on the contrary, it usually occurs in irregular, circumscribed spots, from the size of a twenty-five cent piece to that of the palm of the hand. Any portion of the organ is liable to suffer, but the parts most frequently affected are the neck and bas-

fond, for the reason, probably, that they are naturally very sensitive, and that they are more exposed from their situation to the exciting causes of the disease. During its progress, the inflammation often spreads from the mucous membrane to the submucous cellular tissue, and from thence to the muscular tunic. The peritoneal investment is rarely implicated, in any considerable degree, however serious the attack. The disease, in this respect, bears the closest resemblance to enteritis, which, commencing in the villous lining of the bowel, gradually extends from one coat to another, until, in many cases, the whole of them are involved in the morbid action. It is difficult to say whether acute inflammation of the bladder ever begins in the muscular tunic, or whether, when it exists, it is not always a secondary lesion. My own observations, as well as analogical reasoning, incline me to adopt the latter view. There are, of course, exceptions, but these, I suppose, are few. One thing is certain, and that is, that in no case of severe cystitis can any one of the coats of the bladder be seriously affected for any length of time without the others becoming also involved.

The *causes* of acute cystitis are many and various. It has sometimes occurred as a consequence of the imprudent use of cantharides, oil of turpentine, nitrate of potassa, and other stimulating articles, from the direct influence, probably, which they exert upon the mucous lining of the bladder. Contusions of the perineum and hypogastrium, from blows, kicks, or falls, may give rise to it; it also originates, and that not infrequently, from the extension of gonorrhoea, from the injection of irritating fluids, from the introduction of catheters, bougies, and sounds, and from the application of blisters. Occasionally it is traceable to the effects of excessive venery, and to inordinate distension of the bladder from neglect to void the urine. Sudden transition from heat to cold, and the repulsion of cutaneous eruptions, also produce acute cystitis, especially in persons of a gouty and rheumatic habit. But the most frequent causes, without doubt, are wounds of the bladder, the presence of calculous concretions, rough horseback or carriage exercise, the intemperate use of stimulating drinks, enlargement of the prostate gland, stricture of the urethra, and injury sustained during parturition, whether from the pressure of the child's head, or the injudicious use of instruments. Finally, we must not omit, in this list of exciting causes, to mention protracted retention of urine, which, it is well known, often awakens violent and even fatal cystitis. The fluid in question

becomes, under such circumstances, a twofold source of mischief, first by its mechanical pressure, and secondly by its chemical action.

Acute cystitis is more common in adults than in children and old people, in the strong and robust than the weak and sickly, and in men than in women. It also occurs more frequently in autumn and winter than in spring or summer, and in cold than in warm climates. Various circumstances, such as an arthritic diathesis, intemperance in eating and drinking, and permanent obstacles to micturition, predispose to its development.

The more important *anatomical characters* of acute cystitis are, increased vascularity, loss of transparency, softening, and deposits of lymph, with alteration of the natural secretion.

The discoloration varies, according to the extent and degree of the morbid action, from the lightest rose to the deepest purple. It usually displays itself in small and tolerably well-defined patches, which are always most distinct at the centre of the inflamed part, from which they gradually diminish in intensity until they are insensibly lost in the surrounding healthy structures. In some cases, especially in such as run their course with great rapidity, blood is effused in the submucous cellular tissue, and the part exhibits a truly ecchymotic aspect, similar to that which is seen in a bloodshot eye. This appearance existed, in a remarkable degree, in the bladder of a young man of about twenty, whose body I examined a few years ago in our University. Nothing was known of his previous history, but it was evident from the condition of his bowels, that he had died of colitis. The bladder contained about four ounces of dirty, turbid-looking urine; and the mucous membrane, at the *bas-fond*, over a space of about three inches in diameter, was of a deep cherry color, from the presence of extravasated blood in the submucous cellular tissue. A portion of the affected surface was incrustated with coagulating lymph, which had to be removed before the extent of the ecchymosis could be fully traced. There can be little doubt that this man had a violent attack of cystitis a short time before his death. The bloodvessels, in this disease, have either an arborescent or capilliform arrangement, according to the severity of the morbid action.

More or less opacity almost always accompanies the discoloration : and when the disease is unusually violent, there is not only some degree of softening, but also considerable tumefaction of the mucous membrane. These changes are generally most conspicuous in those cases in which the inflammation has been somewhat protracted. A

deposit of lymph is rather a rare phenomenon, and appears to occur chiefly, as will be shown elsewhere, as a result of external violence, the inordinate use of cantharides, or the irritation of a calculous concretion. The veins about the neck and base of the bladder are engorged with black blood, and the muscular tunic is preternaturally red, softened, and, in some places, almost gangrenous. When the inflammation has involved the peritoneal investment, this part will be found abnormally vascular, incrustated with lymph, and, perhaps, more or less adherent to the surrounding viscera. In some instances, minute abscesses are seen in the submucous cellular tissue, or in the substance of the muscular coat, and purulent matter in the veins of the neck of the bladder and of the prostate gland. These phenomena are most apt to occur in traumatic cystitis. At the commencement of the disease, the secretion of mucus is somewhat augmented in quantity, but thinner and less viscid than in the natural state. When at its height, it is almost entirely suppressed, and the membrane is consequently somewhat dry, just as in acute inflammation of the Schneiderian membrane; but as this period is always of short duration, the secretion is soon re-established, and often exists in great abundance, being of a thick, ropy consistence, and of a pale straw, grayish, drab, or greenish color. In the higher grades of the disease, the secretion, instead of being mucous, is puriform, or mucopurulent, and tinged with blood, which seems to be poured out, under these circumstances, in the form of exhalation, though occasionally it is no doubt caused by a laceration of some of the capillary vessels.

In violent attacks, the inflammation is no longer limited to the mucous and other tunics of the bladder, but it extends to and involves the surrounding and associated organs. The parts which are more particularly liable to suffer are the ureters and the prostate gland. Along the former the morbid action is propagated to the kidneys, the functions of which are often much deranged, as is evinced by the urinary secretion being either entirely suspended, or very much diminished in quantity, as well as altered in quality. The mucous lining of the ureters, from one extremity to the other, is abnormally red and turgid, and their inferior outlet is sometimes almost obliterated, or choked up with lymph, mucus, or pus, or by all these fluids variously combined with each other. The prostate gland may be considerably swollen, especially when the disease affects the neck of the bladder, and thus seriously complicate the

primary disorder, by increasing the local distress, and serving as a mechanical obstacle to the excretion of the urine.

Having thus noticed the seat, causes, and anatomical characters of acute cystitis, we proceed next to point out its *symptoms*. These vary, of course, according to the period that has elapsed since the attack, the nature of the exciting causes, the age of the patient, and numerous other circumstances, which will readily suggest themselves to the mind of the reader. Generally speaking, the malady is ushered in by bold and well-marked phenomena, so as to afford at once a pretty satisfactory clue to the mischief that is going on in the part affected. The first symptom which usually attracts attention is a dull, obscure, deep-seated pain, or rather a sort of gnawing uneasiness, in the region of the bladder, which, rapidly increasing in intensity, soon extends to the neighboring organs. At this early stage, there is little or no constitutional disturbance; or, if there be any disorder of this kind, it is manifested by slight chills alternating with flushes of heat, some thirst, and a little excitement of the pulse, which is, perhaps, a little more hard and frequent than usual. The patient now begins to experience frequent calls to void his urine, which is expelled in small quantities, or, it may be, drop by drop, accompanied with violent straining, distressing spasm, and a peculiar burning, or scalding, at the neck of the bladder and along the course of the urethra, not unlike what results from the contact of boiling water, melted lead, or hot iron. The hypogastrium is distended, painful, and so exquisitely tender as to render even the weight of the bedclothes intolerable. The limbs are drawn up, and the body bent forward, to relax the abdominal muscles, and relieve the tension of the bladder. As the disease progresses, the desire to pass water becomes more frequent and urgent, the pain in the bladder assumes a lancinating, tearing, or throbbing character, and the small quantity of urine which dribbles off is thick, ropy, and turbid, reddish, or tinged with blood. The pain shoots along the testicles, groins, upper part of the thighs, and spermatic cords, to the sacro-lumbar region, where it is often almost insupportable. It is augmented by the slightest movement of the body, by pressure and percussion, by the passage of the contents of the bowels, by the insertion of the finger into the rectum, and by the introduction of the catheter. The perineum feels sore to the touch, and there is incessant vesical tenesmus, accompanied by a degree of straining, or bearing down, equal to what occurs in childbirth. Notwithstanding these efforts at micturition, which are sometimes almost

without intermission, the urine, never being entirely expelled, gradually accumulates, and the bladder at length ascends above the pubes into the hypogastric region, forming a globular and elastic tumor, exquisitely sensitive under the slightest touch. In some cases there is, almost from the very commencement, a constant stillidium of urine, while in others there is complete retention of this fluid.

When the disease is fully developed, there is always more or less *constitutional* derangement. The pulse is quick, hard, small, and frequent, or frequent and wiry; the skin is hot and dry; the tongue is incrustated with a whitish fur; the appetite is impaired; the thirst is urgent; the bowels are constipated; the countenance is anxious and dejected; and the patient is in a state of constant restlessness and agitation, moaning and sighing, and unable to find relief in any position in which he can place himself. The limbs are drawn up as in acute enteritis, and there is generally great distress in the anus and rectum, from an extension of the inflammation. Nausea and vomiting, with severe precordial oppression, are rarely absent in this stage of the complaint. When the kidneys are implicated, there is more or less uneasiness in the loins, attended occasionally with complete suppression of the urinary secretion. In many cases, the distress in the sacro-lumbar region is excessive; the back feels as if it would break in two, or as if it were sawed in pieces. Towards the close of the disease, the surface is bathed with a cold, clammy perspiration, and exhales a peculiar urinous odor; the mind wanders; hiccup supervenes; the strength rapidly declines; the countenance assumes a Hippocratic expression; the extremities become cold; and the patient finally sinks into a state of coma, from which he is destined never to awake.

Some diversity occurs in the symptoms of cystitis, dependent upon the particular *seat* of the morbid action. When the neck of the bladder is mainly affected, excessive pain and a sense of weight or fulness are experienced in the anus and perineum; there is obstinate retention of urine, with an incessant desire to micturate; and severe stinging or burning is felt along the urethra, from one extremity of it to the other. In some instances, the patient is tormented with frequent erections and itching of the head of the penis. The passage of the catheter causes extreme suffering, and similar effects follow the introduction of the finger into the rectum, and even the process of defecation, especially when the bowels are distended with hardened feces.

When the anterior wall of the bladder is inflamed, there is great tenderness on pressure and percussion, with a sense of constriction, in the hypogastric region; the patient lies on his side, and the knees are partially flexed, to prevent tension of the abdominal muscles. There is likewise, under these circumstances, less pain about the neck of the bladder, the desire to micturate is not so frequent, and the water can be retained longer and better. When the inflammation occupies the *bas-fond*, or inferior part of the bladder, the rectum is more apt to suffer, and the patient is harassed with constant straining and tenesmus. Sometimes the disease is seated round the outlets of the ureters, which thus become involved in the affection, followed occasionally by suppression of urine with its whole train of concomitant evils.

Although very little *urine* is discharged at any one time during the progress of this complaint, yet the quantity expelled in the twenty-four hours is nearly the same as in the healthy state. To the taste it is generally acid, while in its appearance it varies from a dirty drab to a deep red; occasionally it is of a pale lemon color, lactescent, or whey-like. On inspecting it in a transparent vessel, with the aid of a good light, numerous shreds of mucus, or of mucus and lymph, are seen floating in it, which, if the fluid be permitted to remain at rest, gradually subside to the bottom of the receiver, forming a large, ropy, gelatinous-looking mass, equal to one-fifth, one-fourth, or even one-third of the entire excretion. At the commencement of the disorder, the urine is not albuminous, but it seldom fails to become so during its progress. When there is renal complication, the secretion is either entirely arrested, or it is performed very sparingly; notwithstanding which the patient is incessantly tormented with dysury, or a feeling of strangury.

Acute cystitis usually runs its *course* with considerable rapidity. It seldom continues beyond the sixth or eighth day without terminating in resolution, tending to suppuration, passing into gangrene, or assuming a chronic type. When the malady is about to decline, there is a gradual abatement of the pain; the desire to micturate is less frequent; the urine, although still turbid, is more copious; the scalding sensation along the urethra diminishes; and the patient is able to bear pressure on the hypogastrium and perineum. With this abatement of the local suffering there is a corresponding amelioration in the condition of the general system. The thirst and fever decline; the pulse becomes softer and slower; the skin is rendered uniformly moist and cool; the gastric irritability disap-

pers; and the general restlessness ceases. In short, from being an object of the most distressing torments, the poor patient feels as if he were translated into elysium, so great is the change. A sensation of numbness, weight, or uneasiness usually remains in the affected part for several days after the violence of the symptoms has subsided.

The *prognosis* in cystitis depends upon the various circumstances enumerated among the exciting causes. When the inflammation is limited, the constitution sound, and the fever moderate, the disease generally yields very readily to treatment, and may even disappear of its own accord. When, however, the system is enfeebled by previous suffering, debauch, or intemperance, the complaint is to be dreaded, not only on account of the want of power in the constitution to resist its influence, but from its tendency to spread, and to terminate in gangrene. Cystitis from protracted over-distension of the bladder usually proves fatal from the fourth to the sixth day, being preceded by coma, urinous smell of the perspiration, and suppression of the renal secretion. When the disease is associated with stone, stricture of the urethra, enlargement of the prostate gland, or organic lesion of the kidneys, the prognosis is unfavorable, as the worst consequences are to be apprehended. Cystitis from a lacerated wound is more dangerous than cystitis from an incised wound; and the traumatic form of the disease than the idiopathic.

The seat of the disease exerts some influence over its progress and termination. Thus, inflammation of the neck of the viscus may prove dangerous by impeding micturition; and, of the back part of the bas-fond, by obstructing the flow of urine from the ureters. When the disease is situated at the summit, or posterior wall of the bladder, the morbid action may extend to the serous investment, and induce fatal mischief. When the inflammation depends upon retrocedent gout, or rheumatism, it may prove dangerous by resisting the means employed to re-invite it to its original seat. Idiopathic cystitis is more dangerous in men than in women, and in childhood and old age than in youth and middle life.

Treatment.—A due consideration of the nature, causes, and symptoms of this affection cannot fail to lead to the adoption of correct principles of treatment. Inflammatory in its character, the means employed to combat it must be strictly antiphlogistic, or the same precisely as in the phlegmasiæ of other parts of the mucous system. The leading indications, in every case of acute cystitis, are, first, to subdue symptomatic excitement; and, secondly, to quiet local irritation.

For accomplishing the first of these ends, the remedies mainly relied upon, in the earlier stages of the complaint, are general and topical *bleeding*, cathartics, and diaphoretics, aided by an antiphlogistic regimen. Promptly and vigorously employed, there are few cases of acute cystitis which resist these means beyond the second or third day, and such as do are always more easily managed afterwards by mild treatment. I have repeatedly cut short, by the lancet alone, attacks of this disease so severe as to leave the patient no rest, and so threatening as to induce the worst apprehensions for his ultimate recovery. The same treatment has often promptly succeeded in my hands after other and less efficient means had been employed for days with little or no benefit. A remedy so potent should, therefore, never be neglected, except under circumstances of the most positive contra-indication. It is, of course, not to be inferred from this remark that it is to be resorted to indiscriminately, or without due regard to the activity of the symptoms, the constitution of the patient, and the period of the complaint. If the person be old and feeble, or the attack of considerable duration, the lancet must be used very cautiously, or be altogether superseded by leeches and other measures. Where the remedy is applicable, it should be employed not only early in the disease, but to as great an extent as the system will bear. In a word, we bleed here, as in other violent inflammatory affections, for effect, and not for ounces. As soon as the patient feels faint the arm is tied up, to be re-opened, in urgent cases, as soon as any tendency is perceived to a renewal of the original symptoms.

But I would not restrict the employment of the lancet to the more severe forms of cystitis, or to such cases only as are accompanied by symptomatic excitement. To do so would be to deprive the patient, in many instances, of a most powerful agent in combating what may be considered as the milder cases of this complaint. There is a variety of cystitis, properly denominated acute, as it respects the local distress, in which there is an entire absence of constitutional disturbance, and yet the suffering is exceedingly severe. In these cases there is no remedy, according to my experience, which is followed by such prompt and permanent relief as copious bleeding at the arm. The operation rarely requires to be repeated, and is generally sufficient, with the aid of a gentle laxative and a dose of Dover's powder, to effect a cure in thirty-six or forty-eight hours; sometimes, indeed, much sooner.

The *bowels* demand early attention, especially if they are over-

loaded with fecal matter, the pressure of which would prove injurious to the inflamed and suffering organ. Where there is no marked derangement of the biliary secretion, the best purgative is castor oil, or sulphate of magnesia, aided by an enema of cool water, thin gruel, or soap-suds. If an opposite condition exist, a dose of calomel should be given, either alone, or, in urgent cases, in union with rhubarb and jalap. Under no circumstances is it proper to administer medicines calculated to irritate the lower bowel, and, through it, the urinary bladder. When the secretions have been restored, or corrected, the intestinal canal must be kept open by saline aperients, or slightly stimulating injections. In the use of the latter, care is to be taken that they are not too large, and that the urine be previously evacuated, otherwise their good effects will be more than counterbalanced by their pressure on the affected viscus.

As soon as proper depletion has been practised, and the alimentary canal well cleared out, *diaphoretics* are indicated, and rarely fail to prove beneficial. Various articles may be exhibited for this purpose; but the one which I have found most useful, and which, therefore, I usually employ, is the tartrate of antimony and potassa, in the form of the antimonial and saline mixture, of which the dose is a tablespoonful every two, three, or four hours.¹ This seldom fails to produce copious diaphoresis, to allay vascular excitement, to calm the affected organ, and to keep the bowels in a soluble condition. The dose must always be strictly graduated by the tolerance of the stomach; for the medicine should never be carried so far as to induce vomiting, retching, or griping. Where the skin is already soft, or where a diaphoretic and opiate are required, nothing is so beneficial as Dover's powder, in doses of from ten to fifteen grains, three or four times in the twenty-four hours. This combination is especially valuable in that variety of cystitis which depends upon cold, gout, rheumatism, or irritation of the bowels. Should the stomach be irritable, the effervescing draught would be preferable to the other diaphoretics, both on account of its anti-emetic properties and its action upon the skin.

The action of the above medicines may be favored by *tepid drinks*, the warm bath, and hot fomentations. The best drinks are such as are somewhat demulcent, as gum Arabic water, slippery elm water,

¹ The combination, which I am in the habit of using in this and other forms of inflammation, consists of three grains of tartrate of antimony, forty to sixty drops of laudanum, one ounce and a half of sulphate of magnesia, and eight ounces of water, with a sufficient quantity of loaf sugar to disguise the taste of the ingredients.

rice water, or flaxseed tea, rendered palatable by the addition of a little lemon juice, citrate of potassa, or the neutral mixture. In the use of these and similar articles, care must be taken not to allow the patient to indulge so freely as to run the risk of producing too great a flow of urine; the object should be merely to allay the acrimony of this fluid, and to render it more acceptable, so to speak, to the suffering organ. The fact is, this is a point which cannot be too strongly insisted upon, inasmuch as it materially conduces to the comfort of the patient, by diminishing the necessity for constantly passing his water. For the same reason, his drinks should always be tepid, that they may promote perspiration instead of the renal secretion, as they would if they were cold.

Diuretics, strictly so called, are improper in this affection, and should therefore be avoided. It is only in case the urine is acrid, high-colored, or very scanty, that they are to be thought of, and then none but the mildest articles are admissible. A small quantity of nitrate of potassa, or sweet spirits of nitre, mixed with some demulcent fluid, may, under such circumstances, be given to modify the renal secretion, and allay vesical irritation. All the more stimulating articles, such as turpentine and cantharides, are, as has been just intimated, to be discarded. In the gouty and rheumatic forms of the malady, colchicum is sometimes beneficial, and may be given night and morning, after the force of the disease has been broken, in the dose of one drachm, in combination with a fourth, third, or half a grain of sulphate of morphia.

In the latter stages of the disease, a tea, composed of *ura ursi* and *hops*, in the proportion of one ounce of the former and half an ounce of the latter to the quart of water, proves sometimes highly advantageous. An ordinary-sized wineglassful of this should be given five or six times a day, either alone, or, where there are acid eructations, in combination with fifteen or twenty grains of the bicarbonate of soda. The hop forms a valuable ingredient in this preparation, on account of its soothing effects upon the urinary organs, as well as upon the general system. The medicine should be as fresh as possible, or, in default of this, a certain amount of lupuline should be added to it. In the lighter grades of cystitis, this tea often acts like a charm, promptly allaying the pain and spasm at the neck of the bladder, and powerfully promoting resolution.

Among the more important *local remedies* for arresting cystitis, and tranquillizing the affected organ, are, leeching and cupping, anodyne enemata, fomentations, and the hip-bath. The use of

these means is often indicated at an early period of the disease, and can seldom be entirely dispensed with in any except the mildest cases.

Much benefit is often derived from free local bleeding, which is generally best accomplished, in this disease, by *leeches*, applied either to the perineum and the verge of the anus, to the upper and inner parts of the thighs, or, when the summit of the bladder is affected, to the hypogastric region. The number of leeches to be used must be proportioned to the activity of the local distress, the age and constitution of the patient, and the actual condition of the system. For an adult, in ordinary cases, not less than fifteen or twenty are required, and, in severe cases, a still greater number. After they have dropped off, it is important that the flow of blood should be encouraged for several hours with cloths wrung out of warm water, and frequently renewed. Leeching here, as elsewhere, should never take the place of the lancet; it is only after general depletion has been practised, or, where this is contra-indicated by the state of the pulse and other circumstances, that it should be resorted to. Used with this precaution, it is a most valuable remedial agent, and one which rarely disappoints expectation. In the repetition of it, much judgment is necessary, for the regulation of which experience alone can furnish a safe and satisfactory guide.

The pain and distress in the back, which often constitute a source of so much suffering in acute cystitis, are usually promptly relieved by the application of *cups*, either dry or wet, to the sacro-lumbar region. Mustard plasters, the wet towel, and anodyne embrocations are also highly efficacious under such circumstances, and must not be neglected, especially if the patient is unwilling or unable to submit to cupping. In severe cases, the best application is a large blister, followed by an emollient poultice over the vesicated surface.

Of all the local remedies none hold a higher rank in the treatment of this affection than anodynes, administered by the rectum, either in the form of *injections*, or in that of suppositories. They not only allay pain and spasm, but they quiet the bladder, and render it more able to bear the presence of the urine, a desire to pass which is a principal cause of the patient's suffering. The best form of injection is from half a drachm to a drachm and a half of laudanum to two ounces of tepid water, thrown up with a good pewter syringe, with a long nozzle, which is far preferable to all the patent contrivances of the kind of which I have any knowledge. The bowel should be previously cleared out with a purgative, or an

enema, and care should be taken not to force the fluid against the anterior wall of the rectum. The quantity of laudanum here specified is a dose for an adult; for a younger subject, or a person enfeebled by age and disease, a smaller quantity will suffice. The repetition of the medicine must be regulated by circumstances; if it pass off soon after it is administered, it should be immediately renewed, and the same rule should be enforced, if it is retained, provided it does not answer the desired end in two or three hours. Where laudanum is inadmissible, on account of some idiosyncrasy, black-drop, or morphia, may be employed as a substitute.

Anodyne *suppositories* are generally beneficial in acute cystitis, and may often be advantageously used in place of injections, especially when, in consequence of tenderness or disease of the anus, the latter are difficult of administration. They may be composed of various articles, but the best is powdered opium, thoroughly mixed with conserve of roses, and introduced upon the end of the forefinger, well oiled. The quantity of opium, thus inserted, should vary from two to four grains, according to the urgency of the local and general distress. Morphia, lactucarium, and cicuta, may be used as a substitute, but are not equal to this substance.

As auxiliary remedies, in the treatment of this disease, mention may be here made of *fomentations* with cloths wrung out of hot water, either simple, or medicated with laudanum, laudanum and camphor, poppies, or hops. The cloths should consist of flannel, arranged in six or eight thicknesses, and should be sufficiently large to invest the whole abdomen, from the pubes to the epigastrium. To prevent evaporation, and confine the heat, the surface of the flannel should be covered with a piece of oiled silk. In cold weather, two sets of cloths ought to be used, in order that no unpleasant reaction may take place while they are being changed. When thus employed, fomentations are often exceedingly grateful to the affected part, as well as to the general system, from the tendency they have to relieve pain and spasm, and to promote perspiration.

The warm *hip-bath*, or immersion of the entire body in warm water, is sometimes eminently serviceable in relieving the local suffering, and exciting the emunctories of the cutaneous surface. Generally speaking, the latter is to be preferred to the former, on account of the greater convenience and less fatigue which attend its administration, as well as the more thorough relaxation of the system. The temperature of the water should range from 85° to 92°,

and the immersion should be continued from twenty minutes to an hour, according to the effects of the remedy, which should always be carefully noted. Transient bathing is commonly worse than useless, inasmuch as it only serves to harass and excite the patient, without being followed by any compensating benefit. The hip-bath is objectionable, chiefly because its employment is attended with great bodily constraint, and consequent inconvenience and fatigue.

The exciting causes of this disease lead to certain modifications of the treatment, which should be well understood by the practitioner. The principal circumstances which require to be considered in this relation are urinary concretions and other foreign bodies, the use of cantharides, the extension of gonorrhoeal inflammation, the repulsion of gout, rheumatism, and cutaneous eruptions, stricture of the urethra, and enlargement of the prostate gland. A few remarks under each of these heads will be sufficient for my purpose.

The treatment of cystitis, dependent upon the presence of a *calculus*, is to be conducted upon general principles; no effort should be made to extract the foreign body, much less to break it up. The organ, perhaps accustomed for a long time to its contact, may be temporarily annoyed, if not overpowered, by the intruder, but with the assistance of antiphlogistic means, early and efficiently employed, it will soon be able to shake off the disease thus awakened, and return to its pristine condition. To cut out the stone, under such circumstances, might prove fatal; to crush it, would be certain to be so. When the inflammation is subdued, the foreign body is removed, and recurrence of the disease prevented.

The case is different when the cystitis has been induced by the presence of a *foreign substance* which has penetrated the bladder from without, as a splinter, or piece of bone. Here the first object should be to remove the extraneous body as early as possible, on the well-known principle that the disease induced by it cannot be cured as long as it remains in contact with the affected viscus.

Cystitis, caused by the absorption, or internal use of cantharides, requires a treatment somewhat peculiar. This variety of inflammation, technically called *strangury*, is induced by the specific action of cantharidin, the proximate principle of the fly, upon the neck of the bladder, terminating in a constant desire to pass water, accompanied with excessive pain and spasm at the neck of the organ, and horrible scalding along the urethra. The symptoms are generally urgent, and therefore require prompt and vigorous interference. A large emollient poultice is applied to the vesicated surface, hot cloths

are laid upon the abdomen, the perineum, and the genitals, and a drachm of laudanum, mixed with two ounces of tepid water, is injected into the lower bowel. Demulcent drinks, with sweet spirits of nitre, are freely taken; and, in severe cases, a full anodyne is exhibited by the mouth. A popular remedy, of great value in this affection, especially in its milder forms, is a decoction of parsley root and water-melon seeds. It should be used as freely as the stomach will bear, either alone, or in combination with spirits of nitre and paregoric. There are few cases of strangury which resist these means, or which require more active treatment, as bleeding, purging, diaphoretics, and the warm bath.

Dr. Mulock,¹ of Dublin, has recently found great benefit in strangury from blistering with cantharides from the solution of potassa—the *liquor potassæ* of the United States Pharmacopœia—in doses of thirty drops every hour. In three cases, treated in this way, speedy relief was obtained. He was led to the use of this preparation from its known efficacy in allaying irritation of the bladder from other causes. It should be exhibited largely diluted with some demulcent fluid.

Cystitis, occasioned by an extension of *gonorrhœa*, is characterized by severe tenesmus, a frequent desire to micturate, and great pain in passing the last drops of urine, which is sometimes tinged with blood. The inflammation, which may occur at any period of the specific disease, is, in great measure, confined to the neck of the bladder, and rarely assumes a violent character. The treatment is strictly antiphlogistic, aided by the internal exhibition of copaiba, and the use of anodyne enemata.

When cystitis depends upon a *gouty* or *rheumatic* state of the constitution, or upon a retrocession of these diseases, colchicum is indicated, and ought to be conjoined with other antiphlogistic means. The dose of the medicine, and its mode of administration, must be regulated by the circumstances of each individual case, and hardly admit of precise detail. My own experience has led me to conclude that one full dose, given at bedtime, is preferable to small ones, frequently repeated.

Another valuable remedy in this variety of cystitis is calomel, administered with a view to its constitutional effects. In obstinate cases of this kind, it is, in fact, almost indispensable. It may be given, three or four times a day, in doses of two grains, combined

¹ Dublin Quarterly Journal of Medicine, Aug. 1848.

with half a grain of opium, to prevent it from acting too freely upon the bowels, and aid in procuring sleep. As soon as the gums become tender, the mercury is discontinued, or administered in smaller quantity or at longer intervals.

When the attack depends upon retrocedent gout or rheumatism, it will be necessary, in addition to the means already specified, to resort to vesication, either with ammonia, hot water, or cantharides. Where the symptoms are so urgent as to require prompt interference, the object in question is best effected with one of the former of these agents; but in ordinary cases preference should generally be given to the fly. The blister should be applied to the seat of the original malady, to re-invite it to the tissues which it has left. Where the local distress is very severe, no harm, but, on the contrary, much benefit, will accrue from placing it over the hypogastric or sacral region, or as near as possible to the organ involved by the translation of the disease. We have the authority of Desbois de Rochefort and others in favor of this practice, of the propriety of which, under the circumstances adverted to, there can be no doubt, notwithstanding the fact that the irritation produced by cantharidin occasionally causes an effusion of lymph upon the inner surface of the bladder.

When the cystitis has been induced by the sudden repulsion of some *cutaneous disease*, as tetter, urticaria, or erysipelas, the indication is to re-invite the disease to its former situation, by the application of blisters, and the exhibition of such means as the state of the system may seem to require.

Finally, when the cystitis is complicated with, or dependent upon, *stricture*, or enlargement of the prostate gland, the treatment must be of a mixed character; an attempt being made, while we endeavor to cure the vesical symptoms, to relieve the pre-existent affection.

I have said nothing, in the preceding pages, of *direct medication* as a means of curing cystitis; because such a mode of treatment is more likely, in my judgment, to do harm than good. It is only in the latter stage of the disease, when the acute symptoms have disappeared, that such a course would be at all admissible, and even then it could hardly be required.

Finally, should *retention* of urine occur, no time is to be lost in having recourse to the catheter. This accident often ensues at an early stage of the disease, and always requires the closest vigilance on the part of the surgeon; for the accumulated fluid not only acts injuriously by distending the coats of the bladder, already crippled and enfeebled in consequence of the inflamed condition of its mus-

cular fibres, but by undergoing speedy decomposition, whereby it becomes a source of direct mischief to the lining membrane. To prevent these evils, the catheter should be used every six or eight hours, or whenever, indeed, there is the slightest tendency to distension, care being always taken to withdraw it as soon as the urine has been evacuated. It has been proposed, under these circumstances, to retain the instrument permanently in the organ for two or three days at a time; but to do this would be to subject the patient to great pain, and the bladder to increased irritation, if not to the danger of gangrene, or perforation of its walls.

SECTION II.

FIBRINOUS EXUDATION OF THE BLADDER.

The mucous membrane of the bladder, like that of the alimentary and aerial canals, is liable to deposits of lymph, which, from the character they play in certain states of this organ, require some notice in this place. Various appellations have been employed to designate this form of inflammation, as fibrinous, plastic, exudative, diphtheritic, and pseudo-membranous, according to the peculiar fancy or notion of different writers. Rokitansky uses the term croupous, evidently from the similarity which the disease, in his opinion, bears to croupous inflammation of the air-passages. The word fibrinous, invented by modern pathologists, is now generally considered as less objectionable than any other, and is, therefore, retained on the present occasion.

Causes.—This variety of inflammation is exceedingly rare as an idiopathic affection; but, as a result of external violence, or direct irritation of the mucous membrane, it is more common than is generally supposed. In calculous disorders, especially when the stone is very rough and bulky, lymph is not unfrequently poured out, not abundantly, it is true, but yet in sufficient quantity to imbed the concretion, either partially or completely, and thus render its extraction very difficult, if not impracticable. Pieces of bougies, bullets, needles, and other extraneous substances are occasionally retained by it, either by becoming encysted, or by being buried in it. It appears, from the observations of Dr. Morel-Lavalée, that a true diphtheritic inflammation of the bladder is sometimes developed under the influence of cantharides, when used as a remedial agent. Since this fact was first enunciated, a few years ago, by this physi-

cian, the occurrence has been noticed by different practitioners, amongst others, by Dr. Amédée Latour, who has recorded a very interesting example of it. Whether, however, it is to be viewed merely as a coincidence, or in the light of cause and effect, is a point which remains unsettled. If we adopt the latter conclusion, which I am not inclined to do, it certainly behooves us to be very cautious in the use of this article. The effect has been most frequently witnessed after the endermic application of cantharides; but it also sometimes takes place in consequence of its internal exhibition.

This form of inflammation, or, more properly speaking, the deposit to which it gives rise, is most common at the neck and base of the bladder, though no part is entirely exempt from it. It has been noticed in both sexes, and at almost every period of life.

The following cases beautifully illustrate this form of vesical inflammation; in two, the disease was brought on by external violence, and in one the exciting cause is not mentioned.

CASE 1.—An old pensioner, in falling from a scaffolding, experienced a severe contusion of the back, followed by retention of urine.¹ The fluid was drawn off regularly for some weeks, when violent pelvic symptoms supervened, and at last nothing but a small quantity of thick pus flowed through the catheter. The suffering becoming more urgent, the bladder, which was very much distended, and had ascended to the umbilicus, was opened above the pubes. Much purulent matter, mixed with fetid urine, escaped from the wound, as also a false membrane, which lined the mucous coat of the viscus. The membrane had a flocculent appearance; in some places it was distinctly fibrous, and, in others, thin and transparent; its inner surface was rough, and raised into minute granules, the result, apparently, of a recent deposit of lymph. The patient died, exhausted, about three weeks after the injury, having, during this period, voided his urine partly by the urethra, and partly by the wound. No dissection seems to have been made after death.

CASE 2.²—A man, aged seventy-seven years, was admitted, in a desperate condition, into the Charity Hospital in Paris, under the care of Dr. Louis, on the 23d of March, 1827. It was ascertained that he had lately been obliged to make water very frequently, but without any pain. Two or three times he voided blood in considerable quantity, and the same occurrence was occasionally noticed for a fortnight before he entered the institution. He died the following night, with marks of gangrene of the lower extremities. The bladder, contracted to about the size of a man's fist, projected slightly above the pubes, and was adherent to the arch of the colon by a membranous band two inches long. It contained between three and four ounces of dark, purulent fluid. The inner surface of the viscus was red, and invested by an adventitious membrane, more than a line thick, and of a filamentous texture, but quite soft and lacerable. The urethra was perfectly sound. The immediate cause of death was a rupture of the left auricle of the heart, within the pericardium.

¹ Liston's Elements of Surgery, p. 489. Phil. 1846.

² Johnson's Medico-Chir. Rev. vol. viii p. 492. New Series,

CASE 8.—A highly interesting and instructive case of the membraniform variety of cystitis was communicated to me, several years ago, by Dr. R. B. Harper, of Tipton County, Tennessee. A boy, three years of age, received, late in the autumn of 1840, an injury from the fall of a rail upon his abdomen, from which, however, he complained very little at the time. Early in January, there was a considerable discharge of blood from the urethra along with the urine, followed, in a few days, by purulent matter and shreds of lymph. There was at first no uneasiness or difficulty in evacuating the bladder, but micturition, by degrees, became painful, and the urine was expelled drop by drop. In the latter part of March, when the little patient fell into the hands of Dr. Harper, there were great distension of the bladder, inflammation of the orifice of the urethra, and an urgent desire to pass water every twenty or thirty minutes, attended with a most distressing, scalding sensation. The catheter was repeatedly introduced, without the slightest relief; the organ retained its abnormal dimensions, and little or no urine followed the effort. Death occurred on the 20th of April, preceded by inflammation of the brain. On dissection, the bladder was found to be nearly filled with half a pint of lymph, which was firmly attached to its posterior wall, between the openings of the ureters, from which a small portion, of a singularly fasciculated appearance, hung forward into the neck of the organ. The whole mass was of a whitish aspect, fibrous in its texture, and evidently organized, numerous vessels being visible in its interior.

Coexistence.—Pseudo-membranous inflammation of the bladder occasionally occurs in association with the same disease in other parts of the body. In the following instance, recorded in the 68th volume of the *Journal Générale de Médecine*, by Dr. Destrées, a French physician, it coexisted with fibrinous exudation of the alimentary canal. A man, presenting all the symptoms of enteritis and cystitis, expelled, while at stool, so large a piece of false membrane that, in his fright, he supposed he was parting with his bowels. He discharged, at the same time, with great pain, from his bladder, a quantity of thick mucus, mixed with portions of lymph.

Physical Properties.—These deposits vary much in their color, consistence, quantity, and mode of arrangement. Generally speaking, they are of a grayish or drab color, but now and then dark brown, greenish, or even reddish, from an admixture of the coloring matter of the blood, a small quantity of which is occasionally poured out along with the fibrinous matter, and thus imparts to it more or less of its characteristic hue. In its consistence, it varies from that of a thin solution of arrowroot to that of the buffy coat of the blood, according to its age and the presence or absence of organization. When the effusion is considerable, different portions often exhibit different degrees of consistence; thus, one part may be perfectly soft, another moderately firm, and a third, perhaps, as tough as a fibrous membrane. The quantity of the deposit is generally small;

though sometimes, as in the case reported to me by Dr. Harper, it is very large, and nearly fills the whole bladder.

Form.—The exudation occurs under several varieties of form. It rarely presents itself as a distinct membrane, spread over the inner surface of the bladder; at all events, it hardly ever covers it in its whole extent. In most cases, it occurs in small patches, from the size of a dime to that of an American dollar, from a fourth of a line to a line in thickness, soft, filamentous, and of a grayish or drab color. Now and then, again, the deposit presents itself in the form of small dots, not larger, perhaps, than a millet-seed, or a pin's head, isolated, or grouped together, and, in their appearance, not unlike little ulcers, for which a superficial observer might, in fact, easily mistake them. A band-like arrangement is sometimes observed, but this is rare, and occurs chiefly in connection with calculous concretions. Finally, this substance most frequently presents itself as an amorphous mass, attached to the bas-fond of the bladder, of variable size, more or less firm in its consistence, and of a dirty grayish or brownish color. Cases occur in which it is prolonged into the urethra and one or both ureters.

It rarely happens that this substance, in whatever form it presents itself, is organized. Such an occurrence is, as a general rule, incompatible with the irritating character of the urine, which, the moment it comes in contact with the deposit, deprives it of vitality, and renders it effete. It is only in rare cases that it retains its plastic nature, that it is vascularized, and that it becomes, so to speak, "part and parcel" of the membrane upon which it is developed.

Effects.—When this substance is deposited in large quantities, it must necessarily considerably diminish the capacity of the bladder, and seriously embarrass its functions. I have already alluded to the fact that it occasionally invests urinary concretions, and renders their extraction difficult, if not impossible. When it extends into the urethra, it may choke up that passage, and thus impede the flow of urine. I have several times seen complete retention ensue from this cause. Prolonged upwards into the ureters, it interferes with the descent of the urine from the kidneys into the bladder, an occurrence which has occasionally led to fatal results. Fortunately, however, in most cases, this substance is discharged almost as fast as it is secreted, and thus the evil consequences alluded to are prevented.

Symptoms.—There are no symptoms by which this form of in-

flammation is distinguishable from ordinary cystitis. The only circumstance upon which the slightest reliance can be placed is the presence in the urine, or at the orifice of the urethra, of some of the exuded matter; but as this may be derived from other sources, as the ureters, the renal calyces, or the urethra itself, it cannot serve as a diagnostic sign.

Treatment.—The treatment of fibrinous inflammation must be conducted upon antiphlogistic principles, which, as they do not present anything peculiar, need not be dwelt upon here. If retention of urine exists, the catheter must be employed, and when there is reason to believe, from the nature of the symptoms, that the bladder is nearly filled with lymph, the proper proceeding is to open it above the pubes, and turn out its contents. Reaccumulation may possibly be prevented by injections of a solution of nitrate of silver, in the proportion of from four to ten grains of the salt to the ounce of water. No internal remedies, so far as our knowledge at present extends, promise to be of any avail in arresting the secretion.

SECTION III.

SUPPURATION AND ABSCESS OF THE BLADDER.

A discharge of pus, or muco-purulent fluid, from the lining membrane of the bladder, although sufficiently common in connection with chronic cystitis, is infrequent as a consequence of the acute form of the disease. The organ, in this respect, bears a striking resemblance to certain portions of the alimentary canal, which perform this act apparently with much reluctance when laboring under high morbid excitement. The discharge, moreover, is usually of brief continuance, and small in quantity, while in chronic cystitis it often lasts for a long time, and is occasionally astonishingly profuse.

The pus in suppurative cystitis varies considerably in its properties. In general it is of a pale straw-color, moderately thick, ropy, and free from odor; sometimes it is greenish or reddish, thin and excessively fetid. These qualities are usually more conspicuous in the chronic than in the acute form of the disease, and are denotive of serious disorder of the lining membrane. The discharge, especially in chronic cystitis, is accompanied with a copious secretion of ropy mucus, with which the matter is intermixed, and which gradually subsides to the bottom of the receiver, often adhering to it with great tenacity. When the quantity of pus is large, or dispro-

portioned to the quantity of mucus, the urine is apt to exhibit a whitish, yellowish, or lactescent aspect, which, however, it soon loses, in consequence of the tendency which these fluids have to separate from each other. The presence of the purulent matter in the urine can always be detected by the sight, aided, in cases of doubt, by the microscope and the ordinary tests.

The matter, instead of being secreted by the free surface of the mucous membrane, occasionally presents itself in the form of an *abscess*, situated in the submucous cellular tissue, or between the muscular and serous tunics. The occurrence, although infrequent, requires to be understood by the practitioner.

Abscesses forming between the coats of the bladder cannot, from the nature of their situation, attain much volume, and we accordingly find that they are seldom larger than a pea, filbert, or a pigeon's egg. The exceptions in which they acquire the magnitude of a walnut, a billiard-ball, or an orange, are exceedingly rare. They may occur in any part of the viscus, but are most frequently observed at its neck; and it is seldom that there is more than one, though occasionally as many as five or six have been observed in the same individual. These abscesses are sometimes of a scrofulous character, in which case the matter is of a curdy or cheesy appearance, similar to that of a tubercular cavity of the lung, or a suppurating lymphatic gland. Under ordinary circumstances, however, it is of a thick cream-like consistence, and of a light yellowish color, as in common phlegmon.

After having existed for an indefinite period, the abscess makes an attempt to evacuate its contents, by exciting ulcerative absorption of the parts by which it is covered. This occurs in different directions, according to the situation of the matter, and the nature of the superincumbent tissues.

a. In the great majority of cases, the matter points inwards towards the cavity of the bladder, into which it finally escapes, and passes off along with the urine. Such a termination is necessarily attended by a sloughy, ragged condition of the mucous membrane, the effect of which, both upon the part and the system, is often most disastrous. The discharge of the matter may be caused simply by ulceration, or it may be produced by the catheter in attempting to draw off the urine, or ascertain the state of the bladder.

b. In the second place, the abscess may open into the rectum, the sigmoid flexure, or the ileum. Of these different communications, the first is the most frequent, as well as the most unfortunate, as it

admits of a constant interchange of the contents of the two passages.

c. A third mode in which the purulent matter may escape is into the uterus or vagina. Examples of this, although exceedingly rare, are mentioned by different authors.

d. In the fourth place, a communication may be established between the bladder and the abdominal cavity, and the matter find an outlet in that way. Such an occurrence is necessarily fatal, as it induces violent inflammation of the peritoneum, causing death in thirty-six or forty-eight hours.

e. A fifth mode of evacuation is through the parietes of the abdomen, above the pubes. This termination is not unlikely to occur when the abscess is developed in the anterior wall of the viscus, in the cellular tissue between the muscular and peritoneal coats. The irritation excited by its presence might lead to an effusion of lymph followed by adhesion of the contiguous surfaces, and subsequently by ulcerative perforation of the wall of the abdomen. In the female, an abscess of the bladder has sometimes opened into the pudendal lip, and in the male, in the loose cellular tissue of the scrotum.

f. Lastly, it is not impossible that a vesical abscess might, under peculiar circumstances, open into an enlarged ovary, ureter, or Fallopian tube. I am not aware that any cases of the kind have been recorded by authors, and I allude to the circumstance as one rather of possibility than of probability.

The matter, instead of being collected into an abscess, is sometimes diffused through the cellular tissue of the coats of the bladder, which, in consequence, exhibit a soft, cedematous aspect, and pit under pressure. Upon puncturing the affected part, at different points, the pent-up fluid escapes as from an anasarctous limb, especially if it be intermixed with serum, and the swelling proportionably subsides. This form of suppuration, of which interesting examples are recorded by Bonnetus,¹ Ruysch,² and other observers, may take place under the influence of calculous irritation, or as a consequence of external violence, which, in fact, is its most frequent cause. The occurrence is, of course, very rare.

Suppuration of the bladder may be the result of idiopathic inflammation, either acute or chronic; or it may be caused by external violence, or by the presence of some foreign body, as a calculus, a bougie, or a catheter. In the latter case, abscesses are generally

¹ Sepulch. Anat. t. xi. lib. 3, p. 590.

² Obs. Anat.-Chirurg. ob. 89, p. 82.

produced, under the influence of protracted irritation, operating directly upon the tunics of the organ. Occasionally there is reason to believe that they are developed in consequence of the irritation of some neighboring or associated viscus, as the ureter, kidney, prostate gland, or uterus. The purulent collections which are sometimes found between the coats of the bladder, after the operation of lithotomy, probably have their origin in phlebitis. Scrofulous abscesses of the bladder are very rare, and are observed chiefly, if not exclusively, in persons of a scrofulous predisposition.

The *occurrence* of suppuration is denoted by frequent chills or rigors, alternating with flushes of heat; by an increase of thirst, anxiety and restlessness; by the character of the pain, which is dull, aching, and throbbing; and by a feeling of weight in the perineum and anus. The mind generally wanders, and, in many cases, there is confirmed delirium. As the fever declines, the urine is secreted more abundantly, and exhibits a peculiar whitish appearance indicative of the presence of pus. In abscess, before the rupture of the inclosing cyst, no such evidence is discernible.

The *diagnosis* of suppurative cystitis is obscure; indeed, it is seldom that the true character of the complaint is revealed until an opportunity is afforded for examining the parts after death. It has been supposed that the gradual subsidence of the inflammatory symptoms, and the appearance of pus in the urine are positive evidences of the occurrence of this event. Nothing, however, can be more erroneous. The symptoms of cystitis may be simulated by other diseases, both of the bladder and of the neighboring organs, and the pus contained in the urine may be derived from an inflamed and disorganized prostate, kidney, or ureter. It is important, therefore, in trying to decide the question of the real character of the disorder, to take into consideration, not merely the actual condition of the patient, but to connect with it, as far as this can be done, its previous history. In abscess, the diagnosis is sometimes determined by the sudden appearance in the urine of a large quantity of pus, after a violent effort at micturition, or an attempt to draw off the urine. Even here, however, it should not be forgotten that the matter may be derived from an abscess of the prostate gland, of the kidney, bowel, or uterus. Infiltration of pus into the coats of the bladder cannot be distinguished during life.

The *prognosis* of suppuration of the mucous membrane of the bladder is usually favorable, especially when it is a termination of the acute form of the disease. Under these circumstances, a ju-

dicious recourse to antiphlogistic measures seldom fails to arrest it, and put a stop to the local disorder by which it has been induced. Suppuration, dependent upon chronic inflammation, often persists for a long time, obstinately resisting every method of treatment that can be brought to bear against it. When produced by external violence, the discharge may be so copious as to bring on hectic fever, with all its train of evils. In calculous disease, the suppuration usually disappears promptly after the removal of the exciting cause.

In abscess the prognosis is, in general, not favorable. Recovery is more likely to take place when the disorder is the result of external violence than when it is the effect of some internal cause. Much, however, must necessarily, under such circumstances, depend upon the nature and extent of the injury. In calculous patients, the prognosis is unfavorable, because abscess after abscess is liable to form, until the patient's strength is undermined by local and constitutional suffering, or his life is destroyed by total suppression of urine.

The *treatment* of suppurative inflammation of the bladder is to be conducted upon general antiphlogistic principles, in its early stages, and, subsequently, upon the tonic and invigorating plan. When hectic irritation is present, the best remedies are quinia and elixir of vitriol, in doses proportioned to the age and condition of the patient. The diet must be bland and nourishing; demulcent drinks must be freely used, to obtund the acrimony of the urine; and the bowels must be maintained in a soluble state, by blue mass and rhubarb, Epsom salts, or calcined magnesia. All local sources of irritation must be removed as early as possible; the catheter is used, if necessary, for the relief of retention; spasm of the bladder is allayed by anodyne suppositories or opiate injections; and sleep is procured by the internal exhibition of opium, the salts of morphia, or black drop. If abscesses point, they must be opened with the knife.

SECTION IV.

GANGRENE OF THE BLADDER.

Acute inflammation of the bladder sometimes ends in gangrene, or a loss of vitality of the affected part. This mode of termination is fortunately infrequent, as the morbid action which gives rise to it is, in general, easily arrested by the early and vigorous employment

of antiphlogistic remedies. It is particularly to be apprehended when the cystitis is marked by great violence, when it has been induced by external injury, and when it occurs in old, infirm, broken-down subjects, or in persons whose health has been much impaired by previous suffering. Sometimes it succeeds to an attack of acute inflammation engrafted upon a chronic one.

Gangrene of the bladder, although it may occur as a consequence of idiopathic inflammation, is almost always a result of external violence, or over-distension from urine. One of the most common causes of this mode of termination is compression of the organ during the passage of the child's head in parturition. The accident is most liable to happen when there is an undue disproportion between the size of the infant and the capacity of the pelvis, coupled with neglect to void the urine. The distended bladder being thus compressed by the uterus not only from behind forwards, but in every direction by its own contents, either bursts, or, what is more likely, suffers severe contusion, which cannot fail to be followed by violent inflammation, and even gangrene. The maladroit application of the forceps or crotchet has occasionally led to similar results. A circumscribed form of gangrene is sometimes produced by the pressure upon a particular portion of the mucous membrane, of the end of a catheter permanently retained in the bladder, for drawing off the urine, as in paralysis of this organ, or in enlargement of the prostate gland.

Excessive distension of the bladder, if long continued, is often followed by extensive gangrene, and is an occurrence, therefore, against which all judicious practitioners carefully guard. All the component structures of the organ are violently stretched, as well as compressed; the vessels and nerves are flattened; the circulation is embarrassed, and finally arrested; and the nervous fluid either ceases to be transmitted, or is no longer capable of exerting its specific influence. The gangrene, in these cases, is frequently preceded by inflammation, but there is reason to believe that it sometimes occurs independently of this process. When the distension is both excessive and protracted, the whole organ may be deprived of its vitality; but in general, the mortification occurs in small circumscribed spots, from the dimensions of a dime to those of a dollar.

Gangrene of the bladder occasionally follows the operation of lithotomy, and laceration of the mucous membrane consequent upon the employment of instruments. From this cause many patients have perished since the introduction of lithotripsy. In performing

this operation there is no little danger, especially in the hands of a young and inexperienced surgeon, of pinching and tearing the coats of the bladder; an effect which is almost sure to be followed by violent cystitis and gangrene. Infiltration of urine into the tissues around this organ may be mentioned as another cause of this mode of termination.

Gangrene of the bladder is occasionally *epidemic*. Mons. Cossy, a French writer, has described, in the *Archives of Medicine*, of Paris, for September, 1843, a well-marked form of this affection in persons laboring under typhoid fever. He observed it very often in the same season, and in the same locality, and was thence led to regard it as of an epidemic character. A similar tendency has been noticed, but less frequently, by other authors. I am not aware that any American writer has met with it.

The period which intervenes between the development of cystitis and the occurrence of gangrene, varies in different cases and under different circumstances. In general, it does not exceed six or eight days; but it may be considerably shorter, and, on the other hand, it is sometimes delayed to the end of the second or the middle of the third week. In traumatic cases, gangrene often occurs at an early stage of the disease, and speedily destroys the patient.

Gangrene may occur in any region of the bladder, and it is impossible to say, in the present state of the science, whether one part is more liable to suffer than another. As in other hollow viscera, it may be general or partial, that is, it may pervade the entire organ, or be limited to particular spots; and, again, it may affect the whole thickness of the organ, or be confined to one or two of its tunics.

The occurrence of mortification of the bladder is *announced* by great prostration of strength; sudden cessation of pain; coldness of the extremities; small, weak, and frequent pulse; profuse, clammy, and offensive perspiration; cadaverous expression of the countenance; mental confusion, delirium, and coma; hiccup; twitching of the tendons; and, towards the close, by colliquative diarrhoea, and involuntary discharge of the feces. The urine is of a brownish or blackish color, emits a peculiarly fetid or cadaverous odor, and is effectually retained by the dead, crippled, or paralyzed organ.

On *dissection*, the mucous membrane is found to be of a dark red, livid, or purple complexion, very soft, easily torn, and bathed with a thin, sanious fluid, of an excessively fetid odor. In some instances, the eschars are of a greenish, grayish, or drab color, and

have a sort of depressed appearance, as if they were sunk beneath the natural level. The parts immediately around the seat of the gangrene are generally remarkably tumid and spongy, from the distension of the capillary vessels and the presence of effused fluids. The submucous cellular substance at the affected part, as well as for some distance beyond, is infiltrated with bloody matter, and yields under the slightest pressure; the muscular fibres are preternaturally dark and lacerable; and the peritoneal investment exhibits all the evidences of high inflammatory action, being more or less discolored, incrustated with lymph, and adherent to the neighboring parts. In cases where the disease does not speedily terminate life, the muscular coat is sometimes denuded over a large space, and the sloughs lie loose in the urinary reservoir, small fragments of them having perhaps been voided during life.

Gangrene of the bladder is sometimes followed by a rupture of the coats of this organ, and the escape of its contents. This event is most likely to happen when there has been protracted retention of urine with inordinate distension, and may take place very suddenly, while the patient, perhaps, is turning about in bed, or during a fit of coughing or vomiting; or it may occur slowly and gradually, as a result of ulceration. In the latter case, the opening is generally small, and is often accompanied by an effusion of lymph upon the outer surface of the organ, or, what is the same thing, by an imperfect agglutination of the bladder to the neighboring parts. When the rupture occurs spontaneously, or under the influence of muscular exertion, it is always followed by an escape of urine, either into the cavity of the abdomen, or into the cellular tissue of the pelvis. In either case, the ultimate consequences are the same. In the former, that is, when the fluid passes into the cavity of the abdomen, violent peritonitis soon arises, attended by the most intense suffering, and terminating fatally in a very few days. The pulse is hard, small, and wiry; the countenance expressive of great anxiety; the skin hot and dry; the breathing hurried and laborious; the belly tense, tender, and tympanitic; the thirst urgent; the bowels torpid; and the bladder, tormented with constant pain and spasm, is unable to expel a drop of urine. Symptoms of exhaustion soon set in, and death is seldom delayed later than the end of the second or the beginning of the fourth day. The patient is sometimes rendered conscious of the rupture by a peculiar noise, or by a feeling of something having suddenly given way. Be this as it may, he is instantly seized with the most agonizing pain, with an inability to move or turn

about, and a sense of profound depression ; symptoms which are always sufficiently characteristic of the true nature of the accident. On dissection, the abdominal cavity is found to be filled with a mixture of serum and urine, highly fetid, and of a dark, dirty appearance ; the peritoneum is injected and covered with lymph ; the bowels and pelvic viscera are glued together, and the bladder, empty or nearly so, is softened, discolored, and torn at one or more points.

When the urine is extravasated into the cellular tissue of the pelvis, the case, as already stated, is equally dangerous, though not generally quite so soon fatal. The symptoms are the same as in urinous infiltration from other causes, and need not, therefore, be described in this place, as they will be pointed out in another part of the work.

The *prognosis* of this disease is always unfavorable. Recovery, it is true, sometimes occurs even when the gangrene is apparently extensive, but such an event must always be regarded as an exceptional one. In general, the inflammation which precedes and accompanies the mortification, even when the latter is slight, is so severe, and causes such an amount of local and constitutional suffering, that few systems, however strong and robust, can withstand its deleterious effects. Aware of these facts, the practitioner cannot be too cautious in delivering his opinion as to the probable issue of any particular case.

The *treatment* of gangrene of the bladder is easily told. The object is to prevent the lesion rather than to cure it after it has been established. With this view, the practitioner must redouble his efforts the moment he sees that this event is threatened, and endeavor, by a judicious and well-directed course of treatment, to arrest the inflammatory action. Should gangrene be inevitable, the indication is to support the system, and by means of quinia, ammonia, brandy, opiates, and nutritious food, assist the patient in throwing off the effects of the local disorder. The distension of the bladder is obviated by the catheter.

SECTION V.

ULCERATION OF THE BLADDER.

Ulceration of the bladder, as an occasional occurrence, has been observed from the earliest periods of the profession, and has been

described, with various degrees of accuracy and minuteness, by different modern pathologists. That this process should now and then present itself is not surprising when we reflect upon the extensive surface of the bladder, the delicacy and great susceptibility of its lining membrane, and the important sympathetic relations which subsist between it and the rest of the organism. That it is much less frequent, however, than it was formerly supposed to be, the concurrent experience of the profession amply attests. Judging from the results of my own observations, both at the bedside and in the dissecting-room, I am disposed to rank it amongst the rarest accidents to which this organ is obnoxious. Of the cause of this immunity we are entirely ignorant. That it depends upon some peculiarity of organization is highly probable; but what this peculiarity is, or wherein it consists, it is impossible, in the actual state of our knowledge, to determine. How far the mucous follicles influence, promote, or prevent the production of ulcerative action, has not been ascertained; all that is positively known is, that certain regions in which these little bodies abound are more prone to suffer from it than others, and with this fact we must, for the present, be satisfied.

Anatomical Characters.—Ulcers of the mucous membrane of the bladder are usually neither numerous nor large. In fact, it is rare, in any case, to find more than two or three, and these may be so small as to elude superficial inspection. This is especially true of the follicular form of the disease, in which the morbid process begins in, and is confined to, these little bodies. Sometimes, however, the number is much greater, and the size more considerable, the lining membrane exhibiting, in consequence, a ragged, riddled appearance. At other times, again, though this is rare, there is one single ulcer, so large as to occupy the greater portion of the organ, and denude the muscular fibres as thoroughly as if they had been dissected by the most skilful anatomist.

Much diversity obtains in regard to the shape and depth of these ulcers. Their most common appearance here, as in the bowels, is that of depressed breaches of continuity of the mucous corion, of a circular or oval form, with the edges slightly elevated above the surrounding level. Not unfrequently, however, they are exceedingly irregular in their figure, and their edges are hard and thick, fissured, puckered, or jagged. Appearances like these are most common in old, chronic cases, but are very rare in such as are recent. In another series of cases, the ulcers are of an irregular form, with undermined, shreddy, ragged edges, the mucous membrane being

raised for some distance from the muscular layer, and almost deprived of its vitality. This variety of the disease is most frequently noticed in follicular ulceration, caused by scrofulous action, and may be shown to great advantage by floating the affected surface in water.

The bottom of the ulcer is originally formed by the submucous cellular substance; but as the disease progresses it may erode the muscular fibres, and even the serous investment. In the latter case, which, however, is comparatively rare, it is not uncommon for perforations to occur, followed by an escape of urine into the abdominal cavity, and the development of fatal peritonitis; or by adhesion of the organ to the neighboring viscera, and the reciprocal passage of their contents. Most generally a communication is established with the sigmoid flexure of the colon or with one of the coils of the small intestine, the parietes of which are firmly glued to those of the bladder by plastic lymph, poured out during the progress of the ulcerative action. In the female, the ulcer sometimes opens into the uterus or the vagina; and, in both sexes, not unfrequently into the rectum.

The ulceration is sometimes *consecutive*, that is, matter is deposited in the submucous cellular tissue, by which the lining membrane is elevated into little abscesses, from the size of a millet seed to that of a small pea. After a while, the covering breaks or sloughs, from the pressure of the pus, and thus an ulcer is formed, exhibiting a foul, ragged aspect, and pursuing the same course pretty much as when the morbid action begins in the mucous corion, or in one of the mucous follicles. When several of these purulent depôts exist in close proximity, they may communicate by fistulous tracks, as abscesses occasionally do beneath the skin and the lining membrane of the bowel. This variety of ulcer sometimes owes its origin to a deposit of tubercular matter, of which I have seen several cases in my own practice, and of which a good example has been recorded by Baillie,¹ in his work on Morbid Anatomy.

Reparation.—The question may now be asked, do ulcers of the bladder ever undergo a process of reparation? Concerning this point, which is one of deep interest in whatever light it can be contemplated, various opinions have been entertained by pathologists. That the occurrence is possible, no one can doubt; but that it is infrequent is a fact which is fully established by daily observation. Indeed, it

¹ Works, by Wardrop, vol. ii. p. 262.

could hardly be expected to be otherwise, if we reflect for a single moment upon the situation, structure, and functions of the bladder, and the heterogeneous nature of the urine. Liable, from its position, to be constantly compressed by the pelvic viscera, subjected to incessant distension, and obliged to undergo frequent contractions, in order to expel its contents, no organ could possibly be placed under more unfavorable circumstances as it respects the healing of an ulcer of its lining membrane. In addition to all this, it should be remembered that the urine itself, from being loaded with acrid matter, or in a state of partial decomposition, becomes a source of irritation, highly prejudicial to the process under consideration. Still, notwithstanding all these disadvantageous circumstances, it cannot be denied, as already hinted, that ulcers of this organ do occasionally heal. In support of this view, it may be stated, first, that these ulcers have been repeatedly found incrustated with plastic lymph, as if nature had been occupied in repairing them; and, secondly, that the mucous membrane occasionally exhibits a puckered and contracted appearance, strongly indicative of complete cicatrization. The possibility of this occurrence is, moreover, rendered highly probable, if not proved, by analogy, or by what is known to happen in other parts of the mucous system. In the alimentary canal, for example, such an event is by no means infrequent, as the dissections of pathologists have clearly established; in the tonsils, mouth, vagina, and uterus, the same thing is constantly witnessed; why, then, should ulcers of the mucous coat of the bladder be regarded as beyond the reach and influence of the same law?

Ulcers of the bladder heal in the same manner as ulcers of the bowels and other mucous canals. Two modes of reparation are generally recognized by pathologists. In one, which is the more frequent of the two, the breach is gradually filled up with granulations, by a process in every respect similar to that which presides over the reparation of an ulcer of the skin. In the other, the surface of the breach is covered with a thin layer or film of plastic lymph, which, pressing down the edges of the ulcer, soon becomes vascularized, and is ultimately transformed into an analogous fibrous tissue. An ulcer that heals in this manner always leaves a sort of scar, or a whitish, puckered, or corrugated appearance, the nature of which is unmistakable.

Causes.—Having considered the mechanism of ulceration, we may next advert to its causes, and the circumstances under which it occurs.

In relation to these points, all the cases which are met with may be referred to two general heads, according as they make their impression upon the mucous membrane in the first instance, or secondarily through the neighboring organs. Uncomplicated cystitis rarely passes into ulceration, while the reverse obtains in that variety of the disorder which depends upon stricture of the urethra, enlargement of the prostate gland, or organic disease of the kidney. Nor is acute inflammation very prone to terminate in this way; on the contrary, in the great majority of instances the ulceration can be distinctly traced to the chronic form of the complaint, and the more protracted this is the more liable does it appear to be to produce this result. Paralysis of the bladder, injury of the spinal cord, and organic lesion of the kidney, are very apt to induce ulceration, from the changes which they create in the composition of the urine, and which seem to act deleteriously upon the sensibility of the lining membrane. But there are other causes which operate, in great measure, if not exclusively, by the mechanical impulse which they communicate to particular parts of the bladder, or even the whole organ. Thus, calculous concretions, or sandy deposits, often induce ulceration, solely by the pressure which they exert upon the mucous membrane. The same thing occasionally happens, though much less frequently than might be supposed, from the introduction and lodgement of foreign bodies, as a piece of bougie, a pin, or a bullet.

A cause very different from any of the preceding is tubercular disease. This implies a peculiar morbid action, not only of the part itself, but of the whole system, and is exceedingly prone to produce ulceration. The tubercular matter, as will be stated in the section on that subject, is generally deposited in the submucous cellular tissue, where, after having remained in a crude state for an indefinite period, it gradually softens, and is ultimately eliminated by the process under consideration. The resulting ulcer, as was previously stated, is generally very small, and rough at the bottom, with thin, ragged, and irregular margins, which are at the same time frequently undermined.

Age, Sex, and Seat.—What influence, if any, age, sex, temperament, occupation, and other circumstances exert upon the production and maintenance of this disease, are points respecting which we have no positive or reliable information. It would appear, from the cases of it upon record, that it is much more frequent in women than in men, and in old, decrepit, than in young, vigorous subjects. Ulceration

may occur in any part of the bladder; but is most commonly met with in the bas-fond and cervical region.

Symptoms.—The symptoms of ulcerated bladder do not differ essentially, in the early stage of the disease, from those of subacute or chronic inflammation. Even at a later period, they are not always distinct, or well-marked. The most prominent local phenomena are, pain and uneasiness in the pelvic cavity, with spasm, frequent micturition, and an offensive state of the urine. The pain is of an acute, burning, or scalding character, and is aggravated by exercise, an overloaded state of the bowels, by pressure on the hypogastric region, the perineum, and the anus, by the finger in the rectum, and by the introduction of the catheter. It often darts along the course of the ureters to the loins, and is always most severe during the passage of the urine and for a few minutes after, when it goes off, but returns again as the secretion accumulates. In many cases, there is severe pain in the loins and kidneys; it is generally intermittent, or liable to temporary exacerbations, and is of a dull, heavy, aching character, though sometimes it is quite acute; occasionally it is distinctly neuralgic. Not unfrequently there is also pain in the groins and the upper part of the thighs. Great tenderness is experienced when the finger, passed into the rectum or vagina, is pressed against the bas-fond of the bladder. In the female, there is often a burning sensation at the orifice of the urethra, and severe pain in the pudendal lips, and even in the pubic bones. The testicles are sometimes exquisitely tender, and there is great distress, with more or less itching, in the prepuce and the head of the penis. In fatal cases, the pain, after having been all along agonizing, sometimes disappears nearly entirely a few days before the patient expires. The same is occasionally true of the desire to make water.

The inclination to urinate is not incessant, but comes on in paroxysms, which gradually increase in frequency, and are attended with intense suffering. Indeed, every effort of the kind, in the more aggravated forms of the complaint, gives rise to the most violent spasm and straining, during which the patient grasps the penis and squeezes it with the utmost firmness; frequently he rolls about in bed or upon the floor, doubles himself up, screams at the top of his voice, turns ghastly pale in the face, and looks as if he were deprived of his reason. During all this time the urine is expelled with much difficulty, or voided in drops, accompanied with an almost insupportable scalding of the urethra. Gradually, perhaps

suddenly, the pain and distress subside, and the patient, exhausted by his exertions, sinks into a somnolent state, from which he is roused in fifteen or twenty minutes to pass through a similar ordeal.

The urine, in this disease, is seldom permitted to accumulate to any extent, and hence it is generally voided in small quantities at a time. The reason of this is sufficiently evident. The urine is not only more irritating than it is in the normal state, but the moment it begins to distend the bladder, the ulcerated surface is put on the stretch, and the organ becomes intolerant of its contents. The patient experiences an immediate and urgent desire to relieve himself, and usually loses no time in obeying his feelings. The fluid, which is generally acid and slightly albuminous, deposits, on cooling, a considerable amount of thick, ropy mucus; sometimes it contains fine shreds of lymph, or the debris of the affected membrane. In the advanced stages of the complaint, it is excessively offensive, of a dark color, occasionally like coffee in appearance, and often mixed with pus, or tinged with blood. An ammoniacal state of this fluid is not uncommon at this period. Where there is extensive destruction of the lining membrane, little or no mucus is seen in the urine.

As the disease progresses, the sympathies and functions of the urinary organs are completely subverted, and the patient's health is materially impaired by the local derangement. His countenance is anxious and sallow, the nervous system is excited and unstrung, he is irritable and feverish, the appetite is disordered, the pulse is small and quick, and there are well-marked febrile exacerbations in the evening, sometimes, indeed, twice a day, preceded by chills or rigors, and followed by copious sweats. In protracted cases, or where the destruction of the mucous membrane is extensive, pains are felt in the perineum and the rectum, only a few drops of urine can be retained at a time, the body is excessively emaciated, and the patient dies gradually exhausted by his suffering. Sometimes, however, on the other hand, the symptoms are comparatively mild, and but little distress is experienced in the urinary apparatus, from the commencement to the termination of the case. This, as will be seen hereafter, is more particularly liable to happen when the disease is of a tubercular character.

Diagnosis.—The diagnosis of this disease is difficult, and cannot always be determined during life. The affections for which it is most liable to be mistaken are simple cystitis, catarrh, and stone.

From the former it can generally be distinguished by its obstinate persistence, by the greater extent and violence of the local distress, by the incessant desire to void the urine, which is never suffered to accumulate, by the more frequent recurrence of spasms, by the more severe burning or scalding along the urethra, and, lastly, by the presence of pus in the urine, and, in the more aggravated forms of the complaint, by the absence of mucus. The latter occurrence is readily explained, under these circumstances, by the destruction of the lining membrane, which, as was previously stated, sometimes pervades the entire organ, denuding the muscular fibres as thoroughly as if they had been displayed by the most careful dissection.

In catarrh, the characteristic symptom is a copious secretion of thick, tough, ropy mucus, with a turbid appearance and an ammoniacal smell of the urine. The local and constitutional distress is less severe than in ulceration, the desire to micturate is not so frequent, there is less sensibility in the urethra, and there is often complete intermission of the vesical disturbance, the patient remaining comparatively comfortable for days and weeks. In ulceration, the symptoms are persistent, and the disease steadily proceeds from bad to worse.

In stone, the pain is most severe immediately after passing the urine, and is generally much aggravated by rough exercise, the urine is also more frequently bloody, there is less irritability of the urethra, and the intervals between the paroxysms are longer than in ulceration. If doubt exist, the sound is used cautiously and gently, lest, if the case be one of ulceration, it increase the local inflammation, and endanger life.

In ulceration there is sometimes a discharge of the debris of the mucous membrane, which never happens in simple cystitis, catarrh, and calculous disorder. It should be carefully distinguished from the shreds of lymph which are occasionally voided in pseudo-membranous inflammation.

When perforations exist, a discharge of gas, fecal matter, ingesta, and other substances, along with the urine, leaves no doubt respecting the nature of the disease. The gas occasionally escapes by the urethra with an explosive noise, or in little bubbles mixed with urine. A discharge of urine by the anus or vulva indicates that the ulcer has taken the direction of the rectum or vagina.

Prognosis.—The prognosis of this disease is most unfavorable. That cures are occasionally effected, and that too without the aid of much treatment, is unquestionably true; but such a result must be

regarded as extremely rare. Generally speaking, the ulcerative process proceeds in spite of the best-directed efforts of the practitioner, gradually undermining the health, and exhausting the vital powers. The period at which death occurs varies from five or six months to several years. In a case of most extensive ulceration of this organ, described by Dr. Budd,¹ of London, the disease proved fatal at the end of the ninth month from the first appearance of vesical symptoms. The patient was a female, fifty-seven years of age. The bladder was entirely denuded of mucous membrane, except at a spot as large as a shilling on the posterior surface of the viscus, just behind the urethra, and at another immediately round the orifice of the right ureter. The muscular fibres were nearly natural in their appearance, and the peritoneal investment was free from inflammation. The left ureter was thickened and ulcerated. Both kidneys were rather small, and the left contained a number of miliary tubercles.

Pregnancy is said occasionally to mitigate the suffering from this disease, and to retard its progress. In 1827, Mr. Coulson² inspected the body of a French woman, who, immediately after her delivery, was attacked with all the symptoms of ulceration of this organ, and died within a week after. "On examination," he says, "the whole inner membrane of the bladder was found completely destroyed. I could not obtain any accurate account of the case, but I learned that the patient, for the few days she was in the hospital prior to her delivery, did not complain of the affection of her bladder. One case, however, I watched from the commencement of the disease, which occurred a month after marriage, to the death of the patient, which took place a month after delivery, and during the latter half of her pregnancy, her symptoms were much milder than before, but soon after the child was born, they returned with their accustomed severity, and destroyed the person." A pathologist cannot fail to recognize here a well-known law, by which one affection often masks another. Pulmonary phthisis, as was long ago observed by practitioners, is sometimes entirely suspended by pregnancy; and every physician has noticed the fact that two severe diseases of any kind can seldom go on at the same time without modifying or counteracting each other.

Effects on Neighboring Organs.—In ulceration of the bladder there is nearly always more or less disease of the urethra, prostate gland,

¹ London Medical Gazette, Nov. 26, 1841.

² Diseases of the Bladder and Prostate Gland, p. 151. London, 1852.

seminal vesicles, the ureters, and kidneys. All these organs are not necessarily involved at the same time, but not unfrequently this is the case, and there are few instances in which several of them do not participate in the vesical affection. The most common lesion of the urethra is inflammation of its lining membrane, which is usually most conspicuous near the neck of the bladder, and is sometimes marked by high vascularity. The prostate gland is usually enlarged, softened in its texture, and engorged with blood; occasionally its ducts are expanded, and its substance is pervaded by pus or sanious fluid. It is rare that this body suffers from an encroachment of the ulceration. The seminal vesicles seldom entirely escape the ravages of the malady. The most frequent morbid appearance of these reservoirs is high discoloration of their lining membrane, with softening of their texture, and an infiltrated and injected condition of the cellular tissue by which they are connected to the bladder. Their contents usually exhibit the character of spoiled semen, which is sometimes of a very fetid odor. The ureters are variously affected; inflamed, ulcerated, dilated, contracted, thickened, or attenuated. The left is said to be more frequently diseased than the right, but in what proportion is unknown. One of the kidneys is sometimes natural, but, in general, both are implicated, though not in an equal degree. The lesion most commonly met with in these organs is inflammation, with ulceration of their substance, and a pretty copious secretion of pus. Another not infrequent effect is atrophy, and cases occur in which one of these glands is converted into a membranous pouch, totally devoid of parenchymatous tissue, and filled with sero-purulent fluid. In the scrofulous variety of ulceration, tubercular deposits are sometimes present in the renal substance. In a case which I shall mention by and by, matter of this kind existed in great abundance, especially in the right kidney.

Morbid Alterations.—The bladder, in this disease, presents no uniformity in regard to its pathological appearances. Its capacity is normal, diminished, or increased; the muscular fibres are preternaturally distinct, and of a deep red color; the mucous membrane, when not completely destroyed, is sometimes covered with patches of lymph, and is nearly always remarkably thick, spongy, and vascular, immediately round the ulcers. Purulent matter, mixed with shreds of fibrin and the debris of the lining membrane, is generally found in the bottom of the bladder, and is derived either from this organ itself or from the ureters and the kidneys. The peritoneal investment, although usually healthy, is sometimes partially covered

with lymph, and pretty firmly adherent to the neighboring parts. Occasionally the coats of the viscus are exceedingly soft, and incapable of resisting the slightest traction. In other cases, again, they are remarkably tough and indurated, owing, doubtless, to interstitial fibrinous deposits.

If *perforations* and adhesions form, in consequence of this disease, it is remarkable how long the patient may live with this loathsome infirmity. Mr. Wilson, of London, in his *Lectures on the Urinary Organs*, alludes to a case in which the bladder and ileum had been united for fifteen years, and yet the patient, during all this time, enjoyed tolerable health. Ulceration, to a large extent, had taken place through the adherent parts, allowing of a free and constant passage of fecal matter from the bowel to the urinary reservoir. The patient died at the age of sixty-eight. Being a female, the shortness of the urethra prevented the retention of the extraneous substance, and no calculus formed. I am acquainted with a clergyman of the German Reformed Church, now eighty-five years old, from whose bladder fecal matter has been discharged for upwards of a quarter of a century. His health, with the exception of an occasional attack of colic, has been excellent. The passage of feces along this route occurred, at first, at long intervals, and rarely continued longer than three or four days at a time; of late, it has been much more frequent, and within the last twelve months, almost constant. When perforation takes place without adhesion, death generally supervenes, in from twenty-four to forty-eight hours, from inflammation of the peritoneum.

When the opening into the bowel is so large as to allow most of the urine to escape by that route, the patient will usually be affected with diarrhoea, excited by the contact of the irritating fluid. In this way, the intestinal disorder may be maintained for many months, perhaps, indeed, for years, without any suspicion on the part of the patient, and his physician, of its real nature.

Treatment.—From what has been said under the head of cystitis, the practitioner will have no difficulty in deducing the principles which ought to guide him in the management of ulceration of the bladder. His conduct here, as in similar affections elsewhere, must be regulated by the age and constitution of the patient, the duration and progress of the disease, the effects of previous treatment, and various other circumstances which will readily suggest themselves to his mind, and which we cannot stop to detail here. At the commencement of the complaint, the means employed to arrest it must

be strictly antiphlogistic, while subsequently they must be modified to meet individual contingencies, as they are developed under the eye of the practitioner. Active depletion by the lancet will seldom be called for after the expiration of the first week or ten days; while the local abstraction of blood by leeches is proper in every stage of the disorder, and constitutes one of our most valuable therapeutic resources. The best regions for applying them are the perineum, the parts around the anus, the upper and inner surface of the thighs, and the inferior portion of the abdomen, the number being proportioned to the exigencies of each particular case.

The *bowels* should be constantly kept in a soluble condition; but active purgation is injurious, and must be abstained from. The best aperients are Epsom salts, castor oil, or a pill composed of equal parts of blue mass and rhubarb. Mercury, with a view to its salivary effects, is of no use, except in the early stage of the complaint, and must, therefore, be avoided. The greatest attention should be paid to the secretions throughout the whole progress of the disease. Any disorder or irregularity of this kind is sure to aggravate the local distress, and therefore requires the most vigilant care.

The *diet* should be light, but nutritious, and consist chiefly of stale bread, toast, mealy potatoes, rice, hominy, and mush, with weak tea or milk at breakfast and supper. Animal food, the coarser kinds of vegetables, condiments, coffee, wine, spirits, acids, and malt liquors, should be interdicted. The drinks, which should be taken in great moderation, so as not to increase unduly the renal secretion, should consist of plain water, linseed tea, or gum Arabic water.

The patient should constantly wear *flannel* next the skin, and carefully guard against sudden vicissitudes of temperature. In the winter, during the cold season, he should reside in a warm climate, where the atmosphere is always perfectly dry, or he should confine himself to a warm room, the air of which should be frequently renewed by ventilation. He should, moreover, keep himself as much as possible in the recumbent posture. Sexual intercourse, and rough exercise of every description, must be carefully avoided.

Of the *internal remedies* calculated to act directly upon the urinary apparatus, the most important are the *pareira brava*, *buchu*, *uva ursi*, *hops*, and *carrot-seeds*, which may be administered either in the form of infusion, decoction, or extract, alone, or variously combined with each other, or with *copaiba*, *cubebs*, *hyoscyamus*, *cicuta*, the *alkalies*, the *mineral acids*, or the *muriated tincture of iron*. These articles are all beneficial in ulceration of the bladder, but experience has

shown that none of them retain their good effects beyond a few days. It is important, therefore, that they should be frequently changed or varied, and not be continued too long at a time.

Whatever mode of treatment be employed, *opium*, *laudanum*, or *morphia*, is indispensable for quieting the bladder and procuring sleep. In fact, without this remedy, life would be utterly insupportable in this disease. Its exhibition is demanded not only by the sound principles of practice, but it is loudly called for by the patient himself, who, aware of its happy effects, often takes it of his own accord, without waiting for the advice of his physician. The most eligible, or least objectionable form of administration is that of an enema, or a suppository; but it may also be given by the mouth, though, in this case, it is more apt to produce constipation and derangement of the digestive function. In whatever manner it be exhibited, it should be employed in full doses, repeated at longer or shorter intervals, according to the exigencies of each individual case. Small doses, frequently repeated, only serve to render the system irritable without relieving the local suffering.

Local remedies, or means addressed directly to the affected surface, are sometimes highly serviceable. Of these the number is very considerable, for there is hardly an article of the *Materia Medica* that has not occasionally been employed; but the best undoubtedly are such as are of an anodyne character, as infusion of poppy, opium, hop, aconite, and cicuta; the salts of morphia have also been recommended; and benefit has sometimes followed the use of tepid water, either simple, or medicated with tar, tannin, sulphate of zinc, creasote, nitrate of silver, and other substances. Lime-water, black-wash, and a weak solution of iodine have occasionally proved advantageous. The amount of reliance to be placed upon these remedies may be readily inferred from their number and variety. Like the internal means, above alluded to, they soon lose their beneficial effects, and are sometimes positively injurious. Great caution, in fact, is always necessary in their employment. The best mode of introducing them is by means of a gum-elastic bag, or patent syringe, carefully adapted to the end of a moderate-sized silver catheter. The quantity of any injection of this kind should not, at first, exceed an ounce, or an ounce and a half; afterwards it may be gradually increased to three or even four ounces. An anodyne injection should be retained as long as possible; an astringent one, not more than a few minutes.

Counter-irritation, in the form of issue, seton, or pustulation with tartar-emetic, is often advantageous in this affection, and should

always be resorted to as early as practicable. The points for establishing it are the perineum and the supra-pubic region. The discharge should be maintained for a long time, and should be promoted, if necessary, by stimulating lotions or unguents.

The urine seldom requires to be drawn off in this disease; a circumstance which is so much the more fortunate, because the use of the catheter is always attended with an increase of pain, and often with positive injury to the affected surface. At no time should the instrument be retained in the organ beyond a few minutes.

ILLUSTRATIVE CASES.

CASE 1.—Symptoms of stone; frequent micturition; excessive pain in the bladder and penis; urine loaded with mucus, and, at times, with lymph and blood; death; complete destruction of the mucous coat of the bladder; ulceration of the left kidney.

A woman, aged thirty-six, supposed to be laboring under stone, was seen by Mr. Coulson,¹ on the 17th of May, 1834. She had frequent desire to make water, attended with darting, shooting pains in the region of the bladder, which were much increased by walking, or exercise of any kind. The urine was acid, and contained some shreds of lymph or mucus. Sounding caused intense suffering, and failed to detect a stone. The pulse was small and quick, the skin dry and rough, the tongue white, and the countenance anxious and expressive of deep distress. She had been in this state for two months. The urine became gradually more loaded with mucus; at times it was tinged with blood; and at length matter was voided with it. These symptoms were succeeded by nausea, complete loss of strength, emaciation, and hectic flushes. On the 24th of November, death put an end to her sufferings. A few days prior to this, the pus ceased to appear in the urine, and the pain and frequent desire to make water, for the only time during her long illness, almost left her.

The bladder was not thickened or contracted, but so completely divested of its mucous membrane that not a single vestige could be seen. No dissection could represent the arrangement of the muscular structure so well as it existed in this case. One spot, of the size of a shilling, towards the fundus, was black, and almost gangrenous. The ulceration had not extended to the urethra, but its lining membrane was highly inflamed. The right kidney was natural, but there was ulceration of the left, and its interior was filled with pus. The renal extremity of the left ureter was blocked up by a detached portion of the substance of the kidney.

CASE 2.—Symptoms of stone; frequent and painful micturition; bloody and mucous urine, with earthy deposits; death; communication between the bladder and ileum.

A fistulous communication occasionally exists between the bladder and the ileum, producing symptoms similar to those of stone. Of this an instructive example is recorded by Mr. Worthington, of England, in the *London Lancet* for July, 1844. The patient, a female, sixty-five years of age, previously enjoying good health, began, four years ago, to suffer from pain in the right iliac region, the cause of which could not be satisfactorily traced. In November, 1842, symptoms indicating disturbance of the urinary organs commenced. Her suffering was much aggravated; she had frequent and painful micturition; and the urine, bloody, ropy, and highly

¹ *Diseases of the Bladder and Prostate Gland*, p. 152, fourth edit. London, 1852.

offensive, often deposited fragments of calcareous matter. The sound was introduced, but no calculus was found, although a distinct grating was felt. The treatment consisted chiefly of anodynes. The patient survived about four months, and died from an attack of diarrhoea. Adhesions were observed between the intestines and the pelvic viscera; and a communication, large enough to admit the end of the index-finger, and evidently caused by ulceration, existed between the ileum and the fundus of the bladder, which were closely united together. The cavity of the bladder was occupied with feculent matter and undigested food, such as currants, seeds, and other vegetable matters.

*CASE 3.*¹—*Symptoms of stone; difficult and painful micturition; purulent urine; passage of gas by the urethra; death; communication between the bladder and rectum, and the bladder and ovary; disease of the left kidney and ureter.*

A married woman, aged thirty-seven, was admitted into the General Hospital at Birmingham, on the 22d of June, 1849, in a state of extreme emaciation, with a countenance indicative of intense suffering. Many years before, two stones were extracted from the bladder. Twelve months ago, she experienced great pain in the left lumbar region, and discharged a large quantity of purulent urine, which was always attended with much difficulty and distress. She was sounded soon after her admission, but no calculus was discovered. During the last year, she had been conscious of having passed air from the bladder, and was thoroughly persuaded that there was an opening between this organ and the bowels. The urine continued to be purulent until the time of her death, which occurred on the 25th of June.

On opening the bladder, which was of moderate dimensions, a small hole was noticed in the left angle of its superior fundus; it communicated with the upper extremity of the rectum, and was surrounded by dark-colored mucous membrane, in a state of granulation. The left ovary, of the size of an orange, was filled with a soft, pulsatious substance, and contained a cavity which opened into the bowel and indirectly into the bladder. "The recto-ovarian did not correspond exactly with the recto-vesical opening, the latter being a little lower in the pelvis, but all were matted together." The left kidney, considerably increased in bulk, was filled with small abscesses and calculi, while the head of the left ureter was greatly dilated, and occupied by a stone as large as a walnut. The liver was hypertrophied, hard, and waxy in its appearance. The remaining abdominal and pelvic viscera were healthy.

In the following case, observed by Dr. Adee, of Oxford, England, the mischief was occasioned by the irritation of the ends of some chicken bones. It is the more interesting from the fact that the symptoms simulated those of stone in the bladder.

CASE 4.—*Symptoms of stone; discharge of pips and kernels of fruit by the urethra; hectic fever; death; fistulous opening between the bladder and rectum; projection of a chicken bone into the former organ.*

A gentleman had been laboring for some years under a fistulous complaint, which was supposed to have left an ulcer, inducing such a drain upon the system as to produce hectic. Of late, he had discharged along with his urine the pips and kernels of some apples and pears, a convincing proof of the existence of a communication between the bladder and the rectum. He was also supposed to have stone, inasmuch as

¹ T. P. Heslop, M. D., Dublin Journal of Medical and Chemical Science, N. S. vol. ix. p. 220. 1850.

his surgeon, in sounding him, thought that he had both felt and heard one, and he would certainly have been lithotomized had he not been so much exhausted by previous suffering. He finally died, and, on opening the bladder, the ends of some chicken bones were found in its cavity. These had been struck by the instrument, and thus deceived the professional attendant.

CHAPTER IV.

CHRONIC LESIONS OF THE BLADDER.

SECTION I.

CATARRH AND HYPERTROPHY OF THE BLADDER.

CATARRH of the bladder, technically denominated cystorrhœa, signifies an inordinate secretion of white, glairy mucus, attended with chronic inflammation of the lining membrane. It is analogous in its character to gleet, leucorrhœa, and other kindred affections, and is generally a symptom merely of a more serious disease. Of the various names that have been employed to designate it, the most appropriate and expressive is cystorrhœa.

This disease has usually been described by authors as consisting of two varieties, the acute and the chronic; an arrangement for which, I conceive, there is no necessity, since the former affection does not differ in any respect from ordinary acute cystitis, described in a preceding chapter. This distinction is of practical importance, and should not be lost sight of in the further consideration of the subject.

Age, Sex, and Season.—Catarrh of the bladder is most common in advanced age. Indeed, it may be said to be almost peculiar to this period. I have never met with it before puberty, except as an attendant upon stone, and but very rarely, under any circumstances, before the forty-fifth or fiftieth year. Persons of a gouty or rheumatic habit are supposed to be particularly obnoxious to it; of this I have witnessed no corroborative facts in my own practice.¹ When the disease

¹ "Most frequently," says Dr. Prout, "it attacks the gouty; and the worst case I ever witnessed occurred in a gentleman, who, for many years, had been a martyr to gout, and in whom it succeeded to an acute seizure in the bladder, that took place during an attack of that affection."—*Treatise on Urinary Diseases*, p. 223. Philadelphia, 1826.

has been once developed, it is no doubt capable of being influenced by this diathesis; but in what degree, or under what particular circumstances, is not known. The disease is also said to be more common in winter than in summer, and in cold than in warm climates. Gunther¹ and Chopart² both assert that it may prevail epidemically. Finally, males are more liable to it than females, for the obvious reason that they are more subject to obstruction of the urinary passages, and to all kinds of exposure.

Causes.—Cystorrhœa is always dependent, directly or indirectly, upon some obstacle to the evacuation of the urine, or upon a diseased condition of the bladder itself. Hence, the most common exciting causes are stricture of the urethra, the presence of a vesical calculus, and enlargement of the prostate gland. In fact, there are few protracted cases of this kind in which this affection is not witnessed to a greater or less extent, or of which it does not constitute in the end a prominent symptom. Nearly all the very worst forms of vesical catarrh I have ever seen have been of this description. Paralysis of the bladder, whether produced by over-distension of the organ by urine, or injury or disease of the spine, frequently gives rise to this state. The muscular fibres having lost their expulsive power, the water is never completely evacuated at any one time, even when the catheter is used, but a portion remains in the bottom of the bladder, where it is speedily decomposed, and thus acts as an irritant to the lining membrane, followed by an inordinate secretion of mucus. Cystorrhœa is a constant attendant upon sacculation, ulceration, hypertrophy, and carcinoma of the bladder. When the affection is once established, it may be easily aggravated or reinduced by exposure to cold, exercise on horseback, sounding, venereal excesses, drastic purgatives, indulgence in ardent spirits, stimulating food, irritating injections, diuretics, and other remedies, as turpentine and cantharides, over-distension of the bladder, neuralgia, retrocession of gout, repulsion of cutaneous eruptions, local injury, and disease of the adjoining parts, as the anus, rectum, vagina, and uterus.

Cystorrhœa generally comes on in a slow, gradual, and insidious manner; and hence there is frequently serious structural lesion before the true character of the malady is revealed, or even suspected. The obstruction to the evacuation of the urine upon which it commonly depends, absorbs for a time the patient's entire attention, and it is only by accident that he is at length apprised of the real condi-

¹ Dencker, *Diss. de Catarrho Vesicæ*. Duisb. 1789.

² *Traité des Maladies des Voies Urinaires*, t. i. p. 412. Paris, 1830.

tion of the bladder. The inflammation which accompanies the affection, and which is always the immediate cause of the cystorrhœa, is of a chronic character, and usually, in the first instance, of a very mild grade. It is for this reason that the term *subacute* has been sometimes applied to it.

Symptoms.—The characteristic symptom of the disease, as was before stated, is an inordinate secretion of mucus. This is associated, in nearly all cases, with an altered condition of the urine, frequent and difficult micturition, pain in the region of the affected organ, as well as in the adjoining parts, and more or less constitutional derangement.

The quantity of *mucus* secreted varies remarkably in different cases and under different circumstances. In the incipient stages, and in the milder forms of the affection, it is generally small, not exceeding perhaps a few drachms in the twenty-four hours. At a more advanced period, the quantity is often considerable; and in some instances the discharge is truly enormous. Barthez mentions the case of a patient who voided not less than fifteen pounds in thirty-six hours. This, however, is a rare exception. Very frequently the mucus amounts to one-third, and even one-half of the entire discharge. It is liable to be increased by the state of the bladder, as well as by that of the system, and generally corresponds with the degree of inflammation of the lining membrane by which it is furnished.

The color of the mucus exhibits almost every variety of shade, from the natural hue to red, brown, or black. The most common tints, especially in the milder forms of catarrh, are white, grayish, and pale drab. A yellowish color is not uncommon, and usually depends upon the presence of a small quantity of pus. When the attendant inflammation is high, the mucus may be of a reddish, brownish, or blackish aspect, from the admixture of blood, either freshly effused, or variously altered by its sojourn in the bladder. A creamy, greenish, striated, or streaked appearance is sometimes observed.

The mucus, in the early period of the disease, is so intimately blended with the urine that it does not become perceptible until the latter begins to cool. It then presents itself in the form of an opaque, grayish, or whitish cloud, fleecy in its appearance, and at first suspended in the fluid, but gradually subsiding to the bottom. Its consistence gradually augments as the urine cools. Not unfrequently it occurs in flakes, strings, or small lumps. In the con-

firmed stage of the affection, it is always thick, ropy, and tenacious, and separates from the urine during micturition, or immediately after. It always in such cases adheres with great firmness to the bottom of the receiver, and is often so glutinous that in pouring it from one vessel into another it draws itself out upwards of a foot in length without breaking.

The mucus, in its odor, usually partakes of that of the urine. In the more aggravated forms of the affection it is generally offensive, and soon decomposed. In its character, it is nearly always alkaline.

The *urine*, in the early stage of the complaint, is nearly natural, both in its color, odor, consistence, and chemical properties. By degrees, however, it assumes a turbid, muddy aspect, becomes more or less offensive, and is thick, acrid, and surcharged with earthy ingredients. It is most commonly of an alkaline character; but sometimes it is acid, and in rare instances neutral. When intermixed with blood, pus, or albumen, it may be of a reddish color, brownish, yellowish, grayish, or lactescent, and of the consistence of a thin solution of starch, isinglass, or arrowroot. The quantity secreted varies, being sometimes small, at other times considerable; occasionally it hardly amounts to four or five ounces in the twenty-four hours.

During the progress of the disease, the urine always becomes highly acrid, so that the bladder can hardly tolerate it even for a few minutes. It generally emits a peculiar ammoniacal odor, is rapidly decomposed, both in the bladder and out of it, and is nearly always mixed with purulent and phosphatic matter. If a silver catheter is used late in the disease, it usually comes out of the bladder of a bronze, brownish, or black color, in consequence of the presence of a minute quantity of sulphuretted hydrogen.

The *pus* which is present in this disease is derived from various sources; sometimes from the bladder, sometimes from the ureters, or the prostate gland, but in general from the kidneys, one or both of which are often seriously involved in the mischief. By rest and cooling, it separates from the urine, and settles at the bottom of the receiver, or, rather, upon the surface or in the substance of the mucus, to which it frequently imparts a striated or punctiform appearance. Its quantity in the twenty-four hours varies from a few drops to several drachms; it is usually of a pale yellowish, ash, or grayish color, and is readily distinguishable by its specific gravity, and globular character. Its presence is always to be regarded with great attention, as it is generally indicative of serious disease of the

organs from which it is derived. It usually possesses an alkaline character.

The matter is often puriform instead of purulent. This appearance is denotive of a milder grade of disease, and often comes and goes as the catarrh, from some accidental or intercurrent circumstance, increases or declines in intensity. The fluid is commonly more intimately blended with the mucus, with which it forms a whitish, grayish, or milky, and tremulous deposit, which becomes quite tough and viscid upon cooling, and always adheres with considerable firmness to the bottom of the receiver. It differs, moreover, from pus, in having an acid instead of an alkaline reaction.

The urine is voided frequently, in small quantity, and with more or less difficulty. Generally, it passes off in interrupted jets, in a small, feeble stream, or in drops, accompanied by violent spasm and straining. Great effort is often required to start it, and it rarely happens that the whole of it is evacuated at any one time. When the urine is loaded with thick, ropy mucus, the difficulty of voiding it is much increased, and the patient is frequently obliged to have recourse to the catheter. The number of times micturition is performed is variable. I have recently had under my care a gentleman from Mississippi, for catarrh of the bladder, caused by a long, narrow, and callous stricture of the urethra, who was obliged to urinate, on an average, every fifteen or twenty minutes. Such examples are, of course, rare; but it is by no means uncommon to see a patient, affected with this disease, make water from thirty to forty times in the twenty-four hours.

The *pain* attending this affection is liable to much diversity. In general, it is of an obtuse, or a dull, heavy, aching character, and is situated low down in the pelvis, from which it radiates along the urethra, the perineum, the anus, and the inside of the thighs. In the more aggravated forms of the disease, it is scalding, burning, pricking or spasmodic, and accompanied with the most violent straining and tenesmus. It is usually most severe during the passage of the last drops of urine, subsides entirely, or in great measure, soon after the micturition is completed, and gradually reappears as the bladder is refilled. In some instances, indeed not unfrequently, a good deal of pain is experienced in the hypogastrium, the testicles, the loins, and the sacrum; in rare cases, it extends down the limbs as far as the legs, and even the feet. It is liable to be aggravated by exposure to cold, venereal indulgence, rough exercise, the erect posture, pressure on the abdomen, drastic

purgatives, and whatever has a tendency to augment the secretion of mucus.

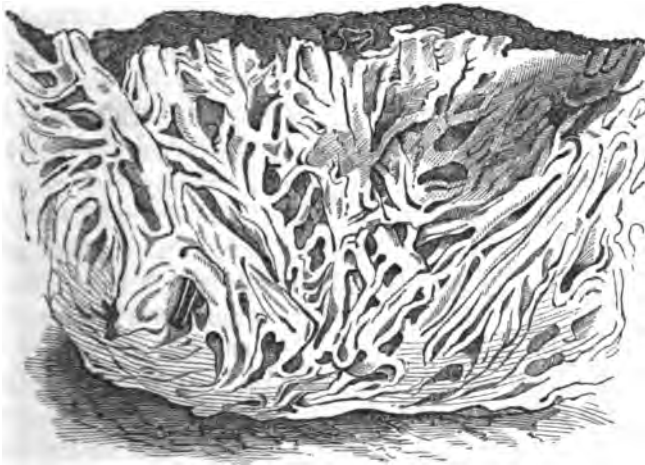
Patients affected with cystorrhœa are sometimes impotent, even if they are comparatively young. I have met with several instances of this kind. In one remarkable case, the gentleman, forty-four years of age, had experienced no sexual desire, for upwards of six years, though he was naturally of an amorous disposition. His penis had become soft and flabby, and had not been in a state of complete erection for a long time. He had occasional emissions, but they were always unaccompanied with the proper feeling. Owing to the frequent micturition which forms so striking a feature of this disease, and the severe straining which generally attends it, catarrh of the bladder is often complicated with hemorrhoids, prolapsion of the bowel, swelling of the testes, and even with hernia.

Diagnosis.—The diagnosis of this disease is always easy. Its characteristic symptom, as before stated, is an inordinate discharge of mucus, dependent upon chronic or subacute inflammation of the lining membrane, and accompanied with frequent, painful, and difficult micturition. Almost the only affection with which it is liable to be confounded is seminal emission; but this can happen only when the seminal fluid flows into the bladder, and mixes with the urine, in consequence of stricture of the urethra, or enlargement of the prostate gland. The distinction is, that in catarrh the discharge is always greater, more constant, and also more ropy, tenacious, and offensive; the local suffering is always more severe, and there is a more frequent desire to urinate. In seminal disease, the matter is voided in small quantity, and at remote intervals; it has a peculiar odor, is of a light color, and is insoluble in the water, in which it floats about in shreds. When there is any doubt, the best way is to submit a few drops of the suspected fluid to microscopical examination. If it be semen, it will be found to consist of small oblong bodies, with delicate tapering tails. From gonorrhœa it is readily distinguished by the character of the discharge, the absence of urethritis, and the history of the case. Its connection with stone can be determined only by sounding. In suppuration of the bladder, the discharge is of a yellowish color, globular in its character, and specifically heavier than in catarrh.

Prognosis.—The prognosis in cystorrhœa varies with many circumstances which hardly admit of precise detail. Much will necessarily depend upon the age and constitution of the patient, the duration of the disease, and the condition of the bladder and of the associated

organs. In its incipient stage, it is sometimes not difficult to cure; but when, commencing gradually, it has at length come to disorder the whole system, it rarely terminates favorably. It not unfrequently remains stationary for a time, or even almost entirely disappears, and then recurs, perhaps with increased violence, merely from the slightest irregularity in diet, drinking a glass of wine, exposure to cold, fatigue, or venereal indulgence. The prognosis is always more unfavorable in old than in young subjects, in protracted than in recent cases, and in the simple than in the complicated forms of the disease. When the kidneys, ureters, prostate gland, or urethra are much involved, the complaint generally proves fatal under the best management; the patient being gradually worn out by local suffering and constitutional irritation.

Fig. 54.



Morbid Alterations.—The morbid alterations observed in those who die of this disease are various. In the early stage, and in the milder forms, the mucous membrane usually presents slight marks of inflammation, with little or no lesion of the other tunics. After some time, however, the muscular fibres become hypertrophied, and exhibit the peculiar retiform arrangement delineated in Fig. 54, from a preparation in my private cabinet. The cellulo-fibrous lamella is also much thickened, as well as increased in density, and the mucous membrane, particularly the portion which corresponds with the base of the organ, is often thrown into large, heavy ridges. In some instances the lining membrane is ulcerated, covered with patches of

lymph, or protruded across the muscular fibres, in the form of one or more pouches. The walls of the bladder are frequently five or six times the natural thickness. The kidneys, ureters, and prostate gland are generally implicated in the mischief; sometimes to a fatal extent.

Treatment.—In entering upon the treatment of this affection, it is of great importance to ascertain the nature of the exciting cause; for the patient may otherwise be put upon a course of remedies calculated to prove useless, if not positively injurious. If there be stricture of the urethra, stone in the bladder, hypertrophy of the prostate gland, or disease of the neighboring and associated organs, it will be imperative upon the practitioner to pursue the respective modes of treatment usually adopted for these several complaints; since, otherwise, no topical or constitutional means can be of the least avail. In truth, the only chance of cure, in nearly all cases, depends upon the early removal of the exciting cause, particularly when this cause interferes with the ready discharge of the urine. A thorough preliminary examination should always be made of the urethra, the prostate gland, the interior of the bladder, and the rectum.

It would be useless to repeat here what has been already said, in other portions of this treatise, respecting the employment of antiphlogistics. The propriety of these measures is self-evident. They are imperatively demanded in all cases attended with violent pain and frequent micturition, even when there is no marked constitutional disturbance. The abstraction, under such circumstances, of fifteen or twenty ounces of blood from the arm will often do more good in breaking up the disease than any other remedies that we possess. Where the lancet is inadmissible, from twenty to thirty leeches may be applied to the perineum and inside of the thighs, or to the lower part of the hypogastric region. The topical bleeding should be followed by the warm bath, warm fomentations, and warm enemata. The bowels must be opened with saline cathartics; or, where the secretions are much deranged, with calomel and jalap. All articles tending to irritate the rectum should be carefully avoided. The most perfect quietude, both of mind and body, must be enjoined; the diet should be as light and unirritant as possible; and the patient should be requested to make free use of demulcent drinks, as gum Arabic water, flaxseed tea, or slippery elm water.

When, by these means, the violence of the disease has been subdued, I know of no remedy so well calculated, in ordinary cases, to ameliorate the morbid condition of the bladder as the balsam of *Opaiha*. This remedy is not new in the treatment of vesical

catarrh. On the contrary, mention of it is made by various authors, both of the last and the early part of the present century. In this country it does not seem to have met with much favor until about fifteen years ago, when the attention of the profession was prominently directed to the subject by my learned friend, Dr. René La Roche, of Philadelphia, in an excellent paper in the fourteenth volume of the *American Journal of the Medical Sciences*. Since that period, I have employed the copaiba in numerous instances of vesical catarrh, and have rarely been disappointed in my expectations. To be effectual, it should be given in doses not exceeding ten, fifteen, or twenty drops, three or four times in the twenty-four hours. The best form is that of emulsion, prepared with gum Arabic and loaf-sugar. Its nauseating, griping, and purging tendencies should be counteracted by combining with each dose a few drops of laudanum, or a small quantity of morphia. Where it does not disagree with the stomach, or produce other mischief, its employment may often be advantageously persisted in for several successive weeks. Small doses are always preferable to large, which are apt not only to cause gastric and intestinal disorder, but also irritation of the urinary apparatus. When the patient is troubled with pyrosis, or acid eructations, the medicine may be advantageously conjoined with bicarbonate of soda.

The *terebinthinate* preparations are sometimes highly beneficial in this affection. They should be used in small doses, largely diluted with gum-water. They may be given by themselves, or in association with copaiba, cubebs, and other articles. The Chian turpentine is, on the whole, the best of this class of remedies, exhibited in the form of pills, with extract of henbane, cicuta, or colchicum.

The *pareira brava*, which has been so much vaunted in the treatment of this affection by Brodie and others, has never accomplished much good in my hands, in any stage of the disease, whether employed alone or in combination with other articles. I have generally found it to create nausea and other disagreeable effects, rendering its continuance improper, at the same time that it did not seem to exert any special influence upon the urinary apparatus. It is usually administered in the form of infusion, prepared in the proportion of half an ounce of the root to a pint of water, of which the dose is from one to two ounces three times a day. I commonly, however, prefer the aqueous extract, combined with opium, morphia, or lupuline, and given in doses of from five to fifteen grains every eight hours.

From *buchu*, another article much extolled in the treatment of catarrh of the bladder, I have never derived much advantage. It is less irritating to the stomach than the *pareira brava*, but can never be relied upon for correcting the discharge, and removing the morbid condition of the mucous membrane upon which it depends. In combination, however, with *uva ursi* and other remedies, presently to be mentioned, it may occasionally be employed with benefit. It is best given in an infusion, in doses of from one to two ounces three or four times a day.

Another article which has a specific tendency to the urinary organs is *uva ursi*. I have used it a good deal in the treatment of cystorrhoea, and have occasionally experienced the best effects from it. I have found it particularly serviceable in cases attended with excessive morbid sensibility of the neck of the bladder. It may be advantageously combined with *buchu*; and, in the class of cases just mentioned, with carbonate of soda or potash. The extract has seemed to me to be less active than the infusion, of which the dose is the same as of *buchu*.

The *epigæa repens*, commonly called the trailing arbutus, ground-laurel, or May-flower, may occasionally prove useful in this malady. It possesses moderately diuretic, as well as slightly astringent, properties, and is closely allied, in its effects upon the urinary organs, to *uva ursi* and *buchu*. The best form of exhibition is a strong decoction, prepared with one ounce of the dried leaves to a pint of water, of which a large wineglassful may be taken every two or three hours. In a case of chronic inflammation of the pelvic viscera, accompanied with suppuration and severe pain of the bladder and urethra, Dr. E. Ives, of New Haven, derived signal advantage from the free use of this medicine after other kindred remedies had failed to afford relief. Dr. Knight, of the same city, has also employed it with marked benefit in a similar instance. The patient had deep-seated inflammation of the perineum, tending to suppuration, and requiring the use of the catheter; it extended to the kidneys, bladder, urethra, and prostate gland, and was attended with morbid secretions, and a highly albuminous state of the urine. A decoction of the *epigæa*, of the strength of two drachms to half a pint of water, was given every two hours, in doses of a wineglassful. In twenty-four hours the urine was free from albumen. The medicine was now omitted, and in twenty-four hours the albumen reappeared. The *epigæa* was again administered, and continued without any return of this substance.

"It is proper to state," observes Dr. Ives,¹ the reporter of the case, "that the inflammation had been subdued by appropriate treatment before the employment of the epigæa, and that the albuminuria appeared as a sequel to the disease."

A combination of some of the articles above mentioned may often be advantageously employed. Indeed, the effect is usually much more conspicuous, when they are given in this manner, than when they are used separately. I have long been in the habit of administering, with the happiest effect, a combination of buchu, uva ursi, and cubeba, sometimes in the form of an infusion, but more generally in that of a tincture, given several times a day in conjunction with a small quantity of bicarbonate of soda. Occasionally, a few drops of the balsam of copaiba, the muriated tincture of iron, or dilute nitric acid, may be advantageously added to each dose of these medicines. When thus combined, it is of course impossible to determine what merit is due to each respective article.

The *muriated tincture* of iron, given by itself, sometimes answers an excellent purpose. It is a valuable tonic, and evidently exerts a direct influence upon the urinary organs. The use of it is particularly indicated in cases attended with a want of appetite, loss of strength, and great pallor of the countenance. The ordinary dose is from ten to fifteen drops three times a day. Cubeba are also sometimes used; and Mr. Brodie speaks favorably of Chian turpentine, given in doses of from one to two grains twice daily.

When the disease is associated with a gouty or rheumatic state of the system, *colchicum* should be employed, and the best form of exhibiting it is in combination with an anodyne. My usual practice is to give one drachm or one drachm and a half of the vinous tincture with fifty drops of laudanum, or half a grain of morphia, every night at bedtime, followed every other morning by a small quantity of Epsom salts and calcined magnesia, to clear out the bowels gently. In some instances, the acetic extract, in the dose of two grains, forms a valuable substitute.

The *benzoic acid* is sometimes used in this disease, and occasionally answers when everything else has failed. I have repeatedly employed it with excellent effects, and can speak positively as to its value in the treatment of cystorrhœa. It may be given by itself; or, what I prefer, in union with the balsam of copaiba. It occasionally acts like a charm. The dose is from five to fifteen grains three or

¹ Transactions of the Amer. Med. Assoc. vol. iii. p. 814.

four times a day, suspended in mucilage of gum Arabic. It may sometimes be beneficially combined with a few drops of Harlem oil.

In all cases of vesical catarrh, the urine should be subjected to the usual tests. If it be found to be acid, the carbonated alkalies should be exhibited, of which the best is soda, given three or four times a day, either alone, or in union with some of the articles above mentioned, in doses of from eight to twelve grains. Weak lye is sometimes serviceable. I have found it of advantage when the usual alkaline remedies have failed. It is prepared by pouring half a gallon of boiling water upon a pint of hickory ashes, and frequently shaking the ingredients. At the end of twenty-four hours the liquor is decanted. The dose is a wineglassful several times a day. If, on the other hand, the urine is alkaline, the employment of the nitric, muriatic, or sulphuric acid is indicated. The use of these different agents is beneficial in neutralizing the irritating properties of the urine, and rendering the bladder more tolerant of its presence.

To allay pain and induce sleep, *anodynes* are indispensable in almost every stage of this disease. They may be given either by the mouth, or by the rectum, in the form of enemata and suppositories. Whenever a necessity for the remedy exists, it should be administered in full doses, repeated at remote intervals. Two grains of opium, half a grain of morphia; or fifty drops of laudanum, are an average quantity in such cases; but sometimes double and triple this quantity is required before the object is attained. An injection, composed of from one to two drachms of tincture of opium and two ounces of starch water, often powerfully contributes to allay the pain and spasm of the bladder. An anodyne suppository not unfrequently answers the purpose much better than an enema. It exerts the same calming influence, and possesses the additional advantage that it does not stimulate the rectum to throw off its contents. An excellent suppository consists of two grains of opium, five grains of camphor, two of extract of belladonna, and five of soap, carefully mixed together, and introduced into the rectum upon the end of the forefinger, or, what is better, a suppository syringe, well oiled for the purpose; the remedy should be repeated two or three times a day, and, in violent cases, much oftener. The addition of the belladonna is particularly valuable in allaying the morbid sensibility of the bladder and rectum, which is sometimes excessive. When a diaphoretic effect is desired along with the anodyne, the most efficient remedies that can be employed are Dover's powder, opium and ipecacuanha, or opium and antimony.

Counter-irritation, in the form of a seton, an issue, or tartar-emetic pustulation, is often highly beneficial in this disease, and should never be neglected in obstinate cases. The best situations for applying it are the perineum and the supra-pubic region. When there is much pain in the back, or when there is reason to suspect the existence of renal disease, the counter-irritation may be established upon the sacrum, or in the loins. The best form is the seton: the issue is inconvenient; and tartar-emetic pustulation is not only painful, but it occasionally induces all the bad effects that result from an overdose of the medicine when taken by the mouth. However produced, it is very important that the discharge should be free, and maintained persistently for a long time. Some of the continental surgeons of Europe are partial, in the more rebellious forms of this affection, to the counter-irritation arising from the application of the moxa or hot iron; but I am not aware that it possesses any superiority over the ordinary issue or seton. Mercurial frictions, and stimulating embrocations, as the volatile liniment, spirits of camphor, and Granville's lotion, have also been recommended; but are seldom productive of much benefit.

Blisters, except at the commencement of the disease, or when there is a sudden aggravation of the discharge, seldom afford much relief. In truth, it is doubtful whether their beneficial effects are not fully counterbalanced by the injurious impression which they sometimes make upon the neck of the bladder, leading to an increase of the local suffering. The parts usually selected for their application are the hypogastrium and the sacrum. Chopart, Desault and others, prefer the inside of the thigh, especially when the attack is dependent upon an arthritic state of the system. In employing these agents, care should be taken to avoid strangury, by sprinkling the surface of the blister with morphia and powdered camphor. Their application should always be succeeded by a large emollient poultice.

The remedies addressed directly to the suffering organ itself, are irrigations, astringent and other injections, and canterization.

Irrigation of the bladder has been much employed of late in the treatment of this affection, and there can be no doubt that it is, in many cases, a valuable auxiliary to the other means already pointed out. The practice, I believe, originated with Mr. Foot, of London, and is highly recommended by different writers. It is particularly valuable when there is an abundant discharge of thick, tenacious mucus, attended with atony of the muscular fibres of the bladder, and

a consequent difficulty of micturition. In these cases, more or less urine is permanently retained in the bladder, and thus becomes a source of mischief. The operation is performed with tepid water, injected with a pint syringe through a double catheter, so that the fluid, mixed with the mucus and other matters, may pass off by one tube as fast as it enters by the other. The instrument should be furnished with spacious eyelets, to prevent obstruction, and should be as large as is consistent with its easy introduction. The operation, which may be repeated once or twice a day, is inadmissible when the urine is bloody, or when there are symptoms of cystitis.

Fluids of various kinds, astringent, anodyne, and alterant, are sometimes introduced into the bladder, for the purpose of making a direct impression upon the inflamed surface. The articles most commonly resorted to are alum, zinc, lead, copper, iodine, nitrate of silver, creasote, opium, morphia, laudanum, cicuta, bichloride of mercury, and nitric acid. In using any of these preparations, the rule is to begin with a very weak solution, and to introduce only an ounce or two at a time. The fluid is thrown in through a common catheter, and is retained from one to five or even ten minutes, according to the tolerance of the suffering organ. The injection is repeated not oftener than once a day, and in some cases only every third or fourth day.

Cauterization with the solid nitrate of silver has been lately recommended by Civiale and other writers. I have made trial of the remedy in a few instances; but do not think it made any decided impression upon the disease. It is chiefly applicable to those cases in which the catarrh is dependent upon inflammation of the neck of the bladder, accompanied with an unusual degree of morbid sensibility. The operation is best performed with a common porteaustique, the cup of which is rapidly passed over the affected surface, and then withdrawn. The bladder is previously emptied, otherwise the salt will be neutralized by the urine. The cauterization is repeated once every fifth or sixth day; oftener than this would prove injurious.

In obstinate and intractable cases of cystorrhoea, where all other remedies have failed to afford relief, it has been proposed to penetrate the neck of the bladder by means of an incision, similar to that made in the lateral operation of lithotomy. The object is to afford a free outlet to the mucous secretion as fast as it takes place, and to put the organ thereby into a state of comparative repose. In a

word, the principle is the same as in the operation for anal fissure and fistule. The wound is not permitted to close too soon, and yet care is taken lest it become fistulous. The operation here mentioned was, I believe, originally suggested by Mr. Guthrie, of London, in his work on the Urinary Organs; but I am not aware that he ever executed it. The credit of doing this belongs, there is reason to believe, to my friend, Dr. Parker, the distinguished professor of surgery in the College of Physicians and Surgeons of New York. His patient, whom I had an opportunity of seeing several times after the operation, was John Peiffer, a married man, aged fifty, a native of Germany, and a cutler by occupation, who was admitted into the Bellevue Hospital, April 10, 1850. Five years ago he contracted gonorrhoea, which lasted five weeks, and was attended with swelling of the testicles. Chronic enlargement of the right deferent duct followed, and, about two years ago, he began to suffer from pain along the urethra, which soon became constant and severe. While in bed, he can retain his water half an hour; but when walking about, he has a desire to pass it every five minutes. A large sound was readily introduced without pain, and without detecting any calculus. He voids in the twenty-four hours about thirty-two ounces of urine, containing a good deal of mucus and some phosphate of lime, but no pus or albumen. The prostate gland seems to be slightly enlarged, but there is no evidence of disease of the kidneys. The bowels are in a soluble condition.

The patient, soon after his admission, was ordered suppositories of opium twice in the twenty-four hours, with an injection into the bladder of Magendie's solution of morphia. The suppositories were continued for four weeks, with but temporary relief. A seton was subsequently introduced into the perineum, and the morphia injection was replaced by a solution of nitrate of silver, in the proportion of ten grains to the ounce of water. No material benefit accrued; on the contrary, the general health continued to decline; he had frequent attacks of vomiting, the pain in the urethra was very severe, and he had a constant desire to pass his water, which always deposited a large quantity of mucus.

Under these circumstances, Dr. Parker was induced, on the 23d of November, to perform the lateral operation. The incision was quite free, and was followed by the loss of about sixteen ounces of blood. For the first twelve hours, the patient experienced severe pain in the bladder, urethra, and left thigh, but this gradually yielded to the liberal use of anodynes. A very decided improve-

ment of the former symptoms soon became apparent; the pulse diminished in frequency; the urine passed off freely by the wound; the patient slept better; and for a time he seemed to be in a fair way of recovery. About the end of the third week, however, he became worse; his strength now rapidly declined; the vesical distress increased; and he began to exhibit all the evidences of a poisoned state of the system from the retention or absorption of urea. He continued in this manner until the 24th of December, when he expired, death having been preceded by delirium and coma.

On dissection, the bladder was found to be greatly contracted; the muscular coat was considerably hypertrophied, and the mucous surface was studded with numerous miliary tubercles. The wound was much reduced in size, and incrustated with earthy matter. The left kidney was slightly enlarged and congested, but otherwise healthy. The right kidney was under the natural size, and was filled with softened tubercular matter. The stomach, heart, and liver were healthy. Both lungs contained tubercles at their summits, and in the left there was a small cavity.

Although this case terminated fatally, yet, from the relief experienced by the patient, it holds out sufficient encouragement to us to repeat the operation in similar instances. From the amount of disease in the kidney, the case was evidently a bad one for the knife. Had the man labored under stone, and been cut for it, he must necessarily have perished at no distant day, probably sooner than he did. Without, therefore, laying down the case of Dr. Parker as the basis of a rule of practice in this distressing and frequently unmanageable affection, I think the treatment adopted by him is worthy of imitation. I shall certainly not hesitate to resort to it the first favorable opportunity that may present itself to my notice. The operation, it seems to me, is particularly applicable to that form of cystorrhoea in which there is marked hypertrophy of the prostate gland and the muscular coat of the bladder.

Finally, in the management of this affection the utmost attention must be paid to the *diet*, which should be of a farinaceous character, perfectly simple, and unirritant. During the existence of a paroxysm of the disease, nothing but arrowroot, tapioca, sago, rice, or gruel, should be allowed, and that only in small quantity. As the symptoms disappear, or when convalescence is fairly established, animal broths and a little of the lighter kinds of meat may be used. But

neither at this nor at any previous period are condiments, as mustard and pepper, admissible. Even salt should be employed most sparingly. The slightest indiscretion in eating will be almost certain to be followed by an aggravation of the complaint, or a return of all the former symptoms. Vegetable acids, subacid fruits, wine, spirits, and fermented liquors are prejudicial, and must be abstained from. The best drink is cold water, either simple or rendered mucilaginous with gum Arabic, slippery elm, or flaxseed. When there is decided debility, the mineral acids, quinia, iron, and the bitter infusions are indicated.

Exposure to cold must be carefully guarded against. Flannel must be worn next the skin, both summer and winter; riding on horseback is to be interdicted; sexual intercourse is to be abstained from; and the bladder must, for a long time, be emptied daily at stated intervals. A residence in a warm climate sometimes exerts a happy influence. Several of my patients have derived signal benefit from spending their winters in New Orleans, Cuba, and Texas.

When the kidneys, ureters, or prostate gland are seriously affected, no remedy, external or internal, local or constitutional, seems to have the power of checking this distressing malady. Life gradually ebbs away, and the patient dies completely exhausted. All we can advise, under such circumstances, is perfect tranquillity, a light but generous diet, anodynes by the mouth and the rectum, the warm bath, and attention to the bowels. Occasionally an accidental hemorrhage occurs, and procures a temporary suspension of the suffering.

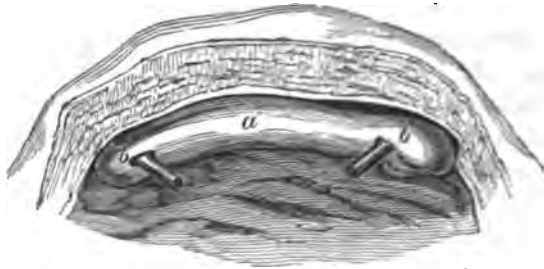
SECTION II.

BAR-LIKE RIDGE OF THE NECK OF THE BLADDER.

A peculiar form of hypertrophy, chiefly affecting the neck of the bladder, is sometimes met with, particularly in old subjects. The disease is probably not infrequent in its occurrence, but from the fact that it has hitherto been generally confounded with chronic enlargement of the middle lobe of the prostate gland, it is only recently that it has begun to excite professional attention. Although incidentally noticed by others, the first clear and accurate account of the lesion was presented by Mr. Guthrie, of London, in his excellent work on the *Anatomy and Diseases of the Bladder and the Urethra*, published in 1834. He has applied to it the appropriate and expressive name of the bar of the neck of the bladder.

The affection, of which the annexed wood-cut (Fig. 55), from a specimen in Dr. Sabine's cabinet, affords a beautiful illustration,

Fig. 55.



Bar-like ridge at the neck of the bladder. *a.* Transverse bar. *b, b.* Orifices of the ureters. The bladder was hypertrophied, and the prostate was enormously increased in volume. The third lobe formed a rounded, prominent mass which projected into the interior of the bladder, and overhung the bar.

consists essentially in an hypertrophied condition of the cellulofibrous lamella at the lower part of the neck of the bladder, which is elevated in the form of a ridge, of variable shape and size. In the preparation from which the drawing was taken, the ridge is fully two inches in length by four lines in height; it lies immediately behind the third lobe of the prostate, which is itself singularly enlarged and disfigured, and is considerably larger on the right side than on the left, where it is comparatively sharp and thin. Its extremities are free; it is directed obliquely backwards, and it is attached by a tolerably thick base to the lower wall of the bladder, of which, in fact, it is a part. Immediately posterior to this ridge is another but smaller one, of the same shape. Beyond this, the surface of the bladder exhibits a remarkably reticulated appearance, from the hypertrophied condition of its muscular tunic, the fibres of which are immensely enlarged, and arranged in bundles similar to the fleshy columns of the heart. The parietes of the organ are upwards of half an inch in thickness, and the prostate gland is more than thrice the natural volume. The middle lobe of this organ is greatly hypertrophied, and consists of three distinct masses, separated by deep grooves; they are rounded off behind, where they are in contact with the main ridge of the bladder already described, and they are quite slender and narrow in front. The patient from whom the preparation was obtained was nearly seventy years of age, and had labored for many years under cystorrhoea, accompanied with excessive suffering and frequent micturition.

The *direction* of this bar or ridge is horizontal, with now and then a slight degree of obliquity. Its ordinary length is from an inch and a quarter to two inches; in height it is from three to five or six lines, and in thickness from two to four. Its free edge is generally blunt and rounded off; but occasionally it is quite thin and sharp. Its extremities are sometimes free, sometimes adherent, or insensibly continuous with the wall of the bladder; or one is free, and the other attached. The base of the bar is usually rather broad, and is firmly attached to the inferior surface of the organ; or, more properly speaking, it is a prolongation of this surface. In some instances, it is double, foliated, or bifurcated. It is of a firm, tough consistence, feeling very much like the uterine tissue, which, after maceration, and immersion in alcohol, it also resembles a good deal in its color. Its complexion, in the recent state, varies according to circumstances, from the slightest change of the natural hue to the deepest purple.

The abnormal ridge is usually very simple in its *structure*. If a careful dissection be made, it will be found, in most cases, to consist merely of a prolongation of the submucous cellular tissue, inclosed by the lining membrane. Occasionally, however, it also contains a few muscular fibres, in a state of thickening and induration. When composed of cellular tissue alone, it is of a pale, grayish, or whitish aspect internally, and so tough and firm in its consistence as almost to grate under the knife that is used for dividing it. When the bar consists partly of cellular tissue and partly of muscular fibres, a section of it usually displays a striated, reddish appearance. Viewed, then, in reference to its structure, the abnormal ridge is in reality nothing more than an unusual degree of hypertrophy of the submucous cellular tissue, or of this substance and the muscular tunic, local and circumscribed in its character. The enveloping mucous membrane is generally more or less thickened, studded with villosities, and pervaded by enlarged capillary vessels.

This variety of hypertrophy is occasionally observed in comparatively early life; but, in the great majority of instances, it occurs in old men who have labored for a long time under vesical irritation. The causes under the influence of which it is developed are such as lead to obstruction to the evacuation of the urine, and the habitual retention of this fluid in the bladder. Hence, the most common exciting circumstances are strictures of the urethra, hypertrophy of the prostate gland, vesical calculi, and the existence of fungous,

fibrous, and other growths, either in the bladder, or in its excretory canal. When any cause of this description is permitted to continue in operation for several years, hypertrophy of the tunics of the bladder, either general or partial, is an inevitable result, in conformity with a law of the economy that muscular fibres and other tissues increase in size in proportion to the manner in which they are exercised and irritated. In partial hypertrophy, seated principally in the submucous cellular substance, there is doubtless not merely an increase from a deposit of nutritive matter, but also, and, perhaps chiefly, from inflammatory plasma.

From the nature of its exciting causes, it might be inferred, *a priori*, that this affection is generally, if not always, coexistent with hypertrophy of the prostate gland, or of the bladder, or, in fact, of both these organs simultaneously. What a process of reasoning, founded upon our knowledge of what occurs under similar circumstances in other parts of the body, might thus assume as a legitimate conclusion, dissection has amply verified. In all the specimens which I have seen of this affection, the coincidence in question was so striking as to leave no doubt upon the subject.

The *symptoms* of this malady, are, in all respects, similar to those which indicate the existence of hypertrophy of the adjoining structures, with mechanical obstruction to the flow of urine. Like chronic disorder of the bladder and prostate gland generally, it is exceedingly insidious in its character, and hence a considerable period commonly elapses before the patient and practitioner are made aware of what is going on. "This disease," observes Mr. Guthrie,¹ "may commence at an early period of life, and can then be kept at bay by the periodical introduction of the catheter; but as long as this source of disease remains, the patient is never safe. It slumbers on like a smothered fire, ready at some future time, when the patient is more advanced in life, or on the application of an additional exciting cause, to burst forth with renewed vigor, and to lead to his destruction by the production of disease in the neighboring parts. Fortunately it is, like the chronic enlargement of the prostate, more commonly the disease of an advanced period of life, and is usually as insidious in its commencement and progress. The patient is aware of there being something the matter with him, but he knows not what; he finds he has a more frequent desire to make water than formerly, particularly at night;

¹ *Op. cit.* page 255.

that it does not flow so readily nor so freely as it had usually done; and that he is more free from irritation whilst his mind is particularly occupied, and especially after dinner, when he can often refrain from attempting to make water for four or five hours. On this account the complaint is frequently attributed to nervousness, or to derangement of the stomach, giving rise to vitiated or faulty secretion of urine."

The malady, thus begun, gradually but steadily proceeds from bad to worse. The obstruction to micturition increases; the inclination to make water recurs from fifteen to thirty times in the twenty-four hours; an unusually long time is occupied in passing it; and, with all the efforts the poor patient can command, he is never able to empty his bladder completely. In consequence of this defect, more or less of the fluid remains constantly in the most dependent portion of the organ, where it soon spoils, and thus becomes a source of additional irritation. At this stage of the affection, the patient is harassed with pain in the bladder, particularly severe at the neck of the viscus, and excessive straining and tenesmus, accompanied by scalding or burning of the urethra, at every attempt at micturition. The urine is loaded with a large quantity of thick, ropy mucus, and emits a fetid ammoniacal odor, which is greatly increased after the fluid has stood a few hours in the chamber. The water is generally acid, but sometimes it is alkaline, and at other times it is alternately acid and alkaline in pretty rapid succession. Occasionally, again, the supernatant fluid is acid, while the thick, viscid mucus beneath is alkaline. The quantity voided in the twenty-four hours is nearly the same as in the natural state, though, in this respect, much diversity occurs in different cases and stages of the complaint. The fluid is commonly surcharged with earthy salts, and has a dirty, turbid, high-colored appearance. Albumen and pus are also frequent ingredients, especially when there is serious involvement of the kidneys, or disorganization of the mucous coat of the bladder.

The health, in due time, begins to suffer. The system becomes feverish and irritable, the countenance has a wan, sallow appearance, the expression is anxious and fretful, the appetite and sleep are impaired, the stomach is weak, acid, and flatulent, the bowels are irregular, the general secretions are disordered, the muscles waste, and the body, once plump and full, is gradually reduced to a skeleton. Thus life slowly ebbs away, the patient literally dying by inches, unless he should be so fortunate as to be seized with

acute cystitis, which, under these circumstances, sometimes terminates his suffering in a few days.

There are, unfortunately, no *diagnostic* symptoms of this lesion. The signs are rather of a negative than a positive character. The prominent phenomena are those of cystorrhœa, which always exist in chronic enlargement of the prostate gland, general hypertrophy of the bladder, stricture of the urethra, and urinary calculi. The embarrassment is not a little increased by the fact that the disease generally, if not invariably, coexists with these affections, either as cause or effect. In all cases, a careful exploration with the finger and catheter should be instituted, as most likely to clear up the difficulty environing the diagnosis. If there be stricture, especially of long standing, the probability is that the symptoms are dependent upon it, and that they will gradually disappear after its removal. Stone in the bladder is, in general, easily detected by the sound; enlargement of the prostate, by the catheter in the urethra and the finger in the rectum. A similar mode of exploration must be adopted when the cystorrhœa, or vesical affection, does not depend upon any of the preceding lesions. The instrument, in this case, will readily pass as low down as the orifice of the bladder, where, meeting the bar, ridge, or artificial dam, it will be either completely arrested, or advance with difficulty. If the finger be now introduced into the rectum, and carried up as high as possible, the point may, if the prostate is nearly of the natural bulk, be hooked round its posterior extremity, and be thus brought directly opposite the bar, and consequently between it and the beak of the instrument. By careful manipulation, we may in this manner not only obtain a knowledge of the existence of the ridge, but also a tolerably correct idea of its form and dimensions. There is no likelihood of such a body being confounded with an encephaloid tumor, inasmuch as the latter is generally very rapid in its growth, soon acquires a large bulk, and is almost always attended with a discharge of blood, which is never witnessed in the bar-like ridge. In encephaloid, moreover, the tumor is commonly situated further back, and does not, consequently, offer so much impediment to the passage of the urine.

The *treatment* of an affection of which the diagnosis is so obscure and difficult of determination, must necessarily be uncertain, if not wholly empirical. The symptoms, in fact, must be prescribed for rather than the lesion which gives rise to them. It is unnecessary here to repeat what has been said, in a previous chapter, upon the

treatment of cystorrhoea, which forms so striking and prominent a feature of the complaint we are now considering. It will be sufficient to state, in general terms, that the remedies which are applicable to that affection are also applicable to this, with the addition of several others presently to be mentioned. *Uva ursi*, *buchu*, balsam of *copaiba*, Chian turpentine, bicarbonate of soda and potass, nitric acid, muriated tincture of iron, benzoic acid, and *hyoscyamus*, are all brought in play, either singly or variously combined, and aided by gentle purgatives, with an occasional dose of calomel, a farinaceous diet, rest of the genital organs, and avoidance of all excitement, both bodily and mental. If much local distress exists, leeches to the perineum and the inside of the thighs, the hot bath, and anodyne enemata must be prescribed. If there is much debility, a little meat may be allowed, with a glass of porter or ale. In general, however, fermented liquors, wine and spirits, are inadmissible. Gin, from its specific tendency to the urinary apparatus, appears occasionally to exert a beneficial effect, and may be used in moderate quantities, in union with gum Arabic water, especially if the patient is of intemperate habits.

The bladder must be relieved with the catheter, used at regular intervals, not too remote nor yet too short, or it must be retained in the organ permanently, being removed occasionally for the purpose of cleanliness. The instrument by its pressure exerts a sorbefacient effect upon the bar-like ridge, and thus aids in reducing its volume, at the same time that it prevents undue accumulation, and the evil consequences resulting from the constant presence of vitiated and offensive urine, mucus, and earthy salts. But the pressure must be gentle and not too persistent, otherwise harm will result instead of benefit. Washing out the bladder with tepid water, slightly impregnated with opium and astringent medicines, is likely to prove useful, and is, therefore, worthy of trial. Cauterization of the part with *Lallemand's porte-caustique* will generally allay the heat and burning pain, and exert a direct and controlling influence over the concomitant morbid action of the mucous membrane in the immediate vicinity of the bar. The operation is performed with great gentleness, yet efficiently, and in such a manner as to bring the nitrate of silver in contact with a surface at least from one to two inches in diameter. The local irritation and distress are temporarily increased, but they subside in a few hours, and never fail to be followed by marked relief, though frequently not until the patient has taken a full anodyne. The cauterization is repeated every sixth

or eighth day, and in the interval the patient is subjected to the treatment already indicated.

Scarification of the bar has been proposed as a remedy in this complaint by Mr. Guthrie, and he speaks of an instrument which he has invented for the purpose. An ordinary Stafford's tube, with a moderate curve, however, will enable any one, skilled in the use of the catheter, to perform the operation with facility. The remedy affords relief by disorgement of the capillary vessels, and stimulation of the absorbents. A repetition of it is called for every fourth or fifth day.

Such are the means at our command in the milder and more common forms of this disorder; it cannot be disguised that they are rather palliative than curative. When they fail, and there is no other prospect of relief, Mr. Guthrie thinks we should afford the patient the benefit of an operation, similar to that which is practised for the removal of the stone. To such a procedure I can see no possible objection; the parts must be relieved, or death will be inevitable. The operation itself does not involve any special danger, the bleeding which attends it will remove vascular engorgement, and the muscular fibres of the bladder will be placed in a quiescent condition, highly favorable to the subsidence of chronic irritation. The urine and mucus will flow off involuntarily, and, unless the wound be permitted to heal too soon, a new and more healthy action will be almost sure to follow.

SECTION III.

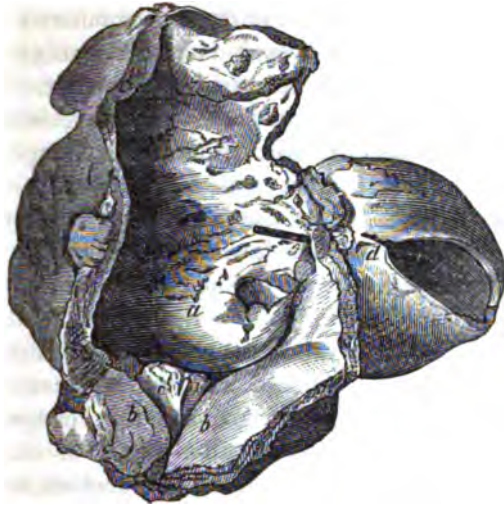
SACCULATION OF THE BLADDER.

This is a very singular affection, which is usually described under the name of hernia of the mucous membrane of the bladder. Chopart has proposed to call it internal cystocele, in contra-distinction to external cystocele, that form of the affection in which the organ issues from the pelvic cavity, either alone or in union with a portion of the bowel. It has also been denominated the sacculated, the encysted, the herniary, and the diverticulated bladder. Broke has described the pouches, of which the disease essentially consists, under the name of *vesical appendages*.

Sacculation of the bladder is a protrusion of the mucous membrane through an abnormal opening in the muscular tunic, and the consequent development of a pouch, bag, or sac. An adventitious

cavity is thus formed, which communicates with the interior of the bladder, and which is very different from the serous cysts which

Fig. 56.



Section of the bladder and prostate. *a*. Mucous surface of the bladder. *b, b*. Lateral lobes of the prostate. *c*. Middle lobe. *d*. Large cyst or pouch, partially laid open, and communicating with the bladder by a small orifice. From a preparation in my private collection.

are found in rare instances in the coats of this reservoir. The affection is much more frequent than is generally supposed. I have repeatedly met with it in my own dissections, and there is hardly a practitioner of much experience who does not occasionally see a case of it.

These *pouches* vary very much both in number, size, and form, as well as in their structure, and the character of their contents. Sometimes there is only one; and, should this be of large size, it may give the organ the appearance of being double. The greatest number I have seen was six. Generally there are not more than two, three, or four. In a case described by Houstel in the *Mémoires de l'Académie de Chirurgie*,¹ there were not less than thirty-eight, all of them very small, and situated chiefly at the lower and back part of the bladder. In their volume, they range between a pea and an ordinary fist. Usually, however, they do not exceed that of a pigeon's egg, or a small marble. In their shape they are globular, ovoidal, pyriform, or conical. At an early period they generally

¹ T. i. p. 195. Paris, 1819.

have thin, transparent walls, formed exclusively by the mucous and peritoneal tunics; but as they increase in age, they are liable to become thickened, dense, and opaque, from interstitial or adventitious deposits. It is seldom that any muscular fibres enter into their structure. Their internal surface is commonly smooth and polished; but in some instances it is rough, spongy, or studded with excrescences. They are covered by the peritoneal coat of the bladder, and not unfrequently adherent to the neighboring parts, in consequence of effusions of lymph. Sometimes, though rarely, they are double, or divided into several compartments by imperfect septa. When the pouches are distended with air, they give, especially when numerous, the bladder a singularly hilly, knobby, or bossalated appearance, at the same time that it sets them off in bold relief.

The opening of communication between the cyst and the bladder is usually round, smooth, polished, and not larger than a goose-quill. Occasionally, however, it is extremely irregular, and so capacious as to admit a finger, or a pullet's egg.

These cysts are usually occupied by *urine*, which, from its protracted sojourn in them, is liable to become decomposed, and to give rise to inflammation, followed by deposits of mucus, and even purulent matter. When they are very large, it is rarely that they are completely emptied at any one time, and hence the same evil consequences that result from partial retention of urine from paralysis of the bladder, or obstruction of the urethra. It is well known that calculous concretions not unfrequently find their way into these abnormal pouches; and in some instances it is not improbable that they are developed in them. Much diversity obtains in these cases in regard to the number, size, and disposition of the foreign bodies. Thus, they may be solitary or multiple, small or large, loose or adherent, smooth or rough; just precisely as in the bladder itself.

There is no part of the bladder that is entirely exempt from this morbid change. Most frequently, however, it is observed at its sides and summit; for the reason apparently that there is less pressure here than in front and behind, and consequently more room for the protrusion of the lining membrane. When the cysts are numerous, they occupy different portions of the organ, though sometimes they are limited to a particular situation.

Sacculation of the bladder is always *associated* with, and, in fact, directly dependent upon, some mechanical obstruction to the ready egress of the urine. The most common causes are stricture of the

urethra, enlargement of the prostate gland, and calculous concretions. Hence the affection is much more frequent in men than in women, in whom there is rarely much permanent impediment of any kind to the emission of the urine. Old age is the period of life most prone to it. I have never seen an instance of it in a young subject, though it may doubtless occur at an early period, especially when it is produced by the presence of a calculus.

The mode of *origin* of these cysts is sufficiently well understood. The first step in their formation is the existence of a mechanical obstruction at the neck of the bladder, or in the urethra, attended with more or less difficulty in voiding the urine. As the obstacle advances, the desire to make water becomes more frequent, and the exertion required to empty the bladder also increases. To surmount the impediment, the muscular coat of the organ is obliged, every few hours, to use the most powerful contraction, in consequence of which its fibres, naturally more closely grouped together at some points than at others, gradually separate from each other, forming a sort of network, the meshes of which vary, in the first instance, from the size of a millet-seed to that of a pea. The resistance of the muscular tunic being thus removed in certain situations, the mucous membrane, pressed upon on every side by the distended bladder, readily enters the crevices, just alluded to, and, by a continuance of the exciting cause, gradually bulges out beyond the level of the peritoneal surface. The process by which these changes are accomplished is slow, and the probability is that many years elapse before the resulting pouches acquire their ultimate limits. Once formed, their tendency is to augment with every increase of the local obstacle upon the presence of which their development depends.

The *symptoms* of this affection are, in general, exceedingly obscure, and it often happens that we are not apprised of its existence until we come to inspect the parts after death. When the abnormal pouch is unusually large, and occupies the summit or anterior surface of the bladder, it may sometimes be felt above the pubes, or between this part and the umbilicus, like a distinct, circumscribed tumor, more or less movable, soft, elastic, fluctuating, and tender on pressure. The instances, however, in which this can be done are rare. No satisfactory idea of the nature of the affection can be derived from an examination with the finger in the rectum. The patient has frequent desire to urinate, and can pass only a small quantity of water at a time; every effort of the kind being attended

with severe straining and tenesmus, during which the body is bent forward, and the hypogastric region is compressed with the hands, to promote the evacuation of the bladder and its appendages. The urine is scanty, surcharged with thick, ropy mucus, and readily decomposed; exhaling, after it has stood a short time, an ammoniacal odor. In the mean time, the general health declines; the patient becomes feverish, the appetite fails, the body is gradually emaciated, and the sleep is much disturbed by the frequent calls to micturition. In a word, all the symptoms, both local and general, of hypertrophy of the bladder are present.

It is obvious that the symptoms here enumerated cannot be regarded as diagnostic of encysted bladder. The only one upon which the slightest reliance can be placed, in this respect, is the existence of a tumor in the hypogastric region. When this is circumscribed, movable, elastic, and fluctuating, and especially when it is only partially emptied at each effort at micturition, and again acquires its former volume as the urine accumulates in the bladder, the presumption is strong that there is a sacculated condition of the mucous membrane. The suspicion is increased, if not converted into certainty, when the swelling disappears under the use of the catheter, which may sometimes, by a happy hit, be passed into the abnormal pouch, and when the patient is laboring under some or all of the rational symptoms above specified. Additional evidence will be afforded if the sac contains a calculus, which never varies its position, but is always perceived at the same point.

Sacculatation of the bladder is always connected with hypertrophy of the muscular tunic, the fibres of which, as already stated, exhibit a plexiform arrangement, and are often three or four times the natural thickness. The mucous membrane and submucous cellular tissue are also more or less altered, the former being frequently thrown into large folds, especially in the bas-fond of the organ, and the latter converted into a tough, grayish substance, very different from the healthy texture. The peritoneal covering is generally sound. More or less disease commonly exists in the ureters and kidneys, similar to what occurs in hypertrophy of the bladder apart from any protrusion of the lining membrane.

The *prognosis* of this disease is eminently unfavorable, not so much on its own account as on that of the morbid changes with which it is generally associated, and which are commonly of an incurable nature. Owing to the peculiar arrangement of the cysts, and the absence in them of muscular fibres, their contents are rarely, if

ever, entirely expelled; the consequence is that they soon become a source of irritation to their lining membrane, followed often by inflammation, and its different products, particularly an inordinate secretion of mucus, or of mucus and pus. Sometimes they become the seat of a large abscess. Gangrene occasionally seizes upon them, and in a few rare instances they have given way at one or more points, followed by an escape of their contents into the pelvic cavity, and the development of fatal peritonitis.

No kind of *treatment*, either local or general, is of any avail in this affection, the morbid changes of which are entirely beyond the influence of remedies. The only method that can be adopted is to remove the exciting cause, and thus prevent any further increase of the difficulty. Any impediment, therefore, to the flow of urine should be sought for, and promptly attended to. The water should be passed at regular intervals, or drawn off with the catheter, to protect the bladder from over-distension and undue exertion. Any inflammatory complications that may manifest themselves must be met by the lancet, antimonials, the warm bath, leeches, fomentations, and anodynes.

CHAPTER V.

NERVOUS AFFECTIONS OF THE BLADDER.

SECTION I.

IRRITABILITY OF THE BLADDER.

THE characteristic symptom of this disease is frequent micturition. In the natural state, the urine is excreted from four to six times in the twenty-four hours; the quantity varying from thirty to forty-five ounces, according to the season of the year, the state of the weather, and the habits of the individual. The act is generally more frequently performed by the male than the female, owing to various circumstances, but chiefly to the smaller size of his bladder, and the fact that he consumes a larger amount of stimulating food and drink. In irritability of the bladder, the urine is voided every hour or two, perhaps, indeed, every few minutes, and the pro-

cess is commonly attended with more or less pain, spasm, and burning at the neck of the bladder and along the urethra. The fluid may be perfectly natural, both in its physical and chemical properties; or it may be increased or diminished in quantity, and variously altered in quality.

Age and Temperament.—The disease is not peculiar to either sex, to any period of life, or to any particular temperament, habit, or occupation. I have, however, most frequently met with it in children and in persons about the age of puberty, and in individuals who are naturally of a nervous, irritable disposition, or prone to attacks of gout and rheumatism. A very unpleasant and intractable form of vesical irritation occasionally occurs in weakly, scrofulous subjects. There is a variety of this affection peculiar to young boys and girls, in which the intolerance of the bladder occurs chiefly at night, during sleep. Particular mention will be made of this variety when I come to speak of incontinence of urine. The malady may affect the whole bladder, or only a part of it; in most cases it is limited to the neck of the organ, and to the prostatic portion of the urethra; regions remarkable for their sensibility both in health and in disease.

Symptoms.—When the disease is fully established, the patient is obliged to urinate every few minutes, and is hardly ever entirely free from suffering. The process, which is generally more frequent in the day than at night, and in the erect than in the recumbent posture, is accompanied with tenesmus, more or less straining, pain at the neck of the bladder, and a sense of scalding in the urethra. The stream of water may be natural, or variously altered in its form and force. Thus, it may be forked, twisted, or spiral, strong and full, small and feeble. In many cases, it is ejected in jets, or voided in drops. The fluid again may be normal as to its quantity and quality, or it may deviate more or less from the healthy standard. In general, it is acid, high-colored, and surcharged with mucus of a whitish or grayish complexion, which gradually subsides to the bottom of the vessel during the process of cooling. In consequence of the straining, the patient often suffers from irritation of the rectum, hemorrhoids, partial prolapsus of the mucous membrane, and pruritus of the anus, or the parts around. The urethra and the prostate gland are generally unnaturally sensitive to the touch, and hence much difficulty is frequently experienced in attempting to introduce a catheter or bougie, which, from the spasm which it excites, is sometimes grasped with extraordinary firmness. A very

common accompaniment of this affection, especially in young men, is a tendency to erections and seminal emissions. Indeed, there are few cases between the ages of twenty and thirty, in which this symptom is entirely absent. Neuralgic pains of the bladder, the penis, testicles, and spermatic cord, are also frequently present, and greatly aggravate the local distress.

As the disease wears on, the general health, perhaps originally good, gradually suffers. The digestive organs lose their tone; the appetite is impaired; the bowels are constipated; and the patient is harassed with flatulence, colicky pains, and acid eructations. The extremities are cold, the sleep is disturbed, the flesh wastes, and the mind is gloomy and despondent. Such is a faint picture of the miserable condition which attends irritability of the bladder in its confirmed stages, and in its more aggravated forms.

Diagnosis.—This disease is sometimes mistaken for stone. In the chapter on urinary calculi, several instances will be mentioned in which this error was committed, and where the patients, in consequence, came very near being subjected to the operation of lithotomy. In the autumn of 1847, a boy, four years of age, with a pale, sickly look, was brought to me from the State of Indiana, with what was supposed to be stone in the bladder. He had an almost incessant desire to micturate, complained of severe pain in the urethra and neck of the bladder, pulled constantly at the prepuce, and strained violently whenever he voided his urine, which was occasionally tinged with blood. Suspecting he had stone, I sounded him repeatedly, but found nothing in the bladder. Upon inquiry, I ascertained that he had had several attacks of intermittent fever during the last eighteen months, and that he had been frequently affected with diarrhoea, alternating with constipation. His urine was acid and rather high-colored. I requested his father to give him, every other night, a dose of calomel and rhubarb, with bicarbonate of soda, and, in the interval, quinine and Fowler's solution; and under this treatment he rapidly recovered. Whenever any doubt exists in regard to the diagnosis of the complaint, recourse should be had to the sound.

Causes.—Irritability of the bladder may be arranged under different heads, according to the causes by which it is induced, or the circumstances under which it is developed. 1. Disease of the urinary apparatus. 2. Altered state of the urine. 3. Diuretic medicines. 4. Disorder of the genital organs. 5. Disease of the alimentary canal. 6. Lesion of the brain and spinal cord. 7.

General debility. 8. Exposure to cold and heat. 9. Disease of the pelvic viscera.

1. Disease of the *urinary* apparatus, no matter what may be its character or situation, is a frequent cause of vesical irritability. As a familiar instance, we may mention stricture of the urethra. In the confirmed stage of this affection, one of the most constant symptoms is a frequent desire to void the urine; and in the female, the presence of warty excrescences, at the orifice of this canal, generally produces similar effects. Persons affected with stone, vesical catarrh, hypertrophy of the muscular coat of the bladder, ulceration of the mucous membrane of this organ, enlargement of the prostate gland, and disease of the ureters or kidneys, are seldom free for any length of time from this kind of irritability, which, in some of the maladies here mentioned, is often a source of the most frightful suffering. The presence of a fungous tumor, a clot of blood, inspissated mucus, coagulating lymph, or purulent matter; in short, of any foreign or adventitious substance, invariably leads to the same result. Howship¹ refers to a case in which the disease was caused by a growth of hair within the bladder. A considerable degree of irritability of this organ sometimes succeeds to the operation of lithotomy, external injury of the bladder, and perineal fistule.

Gonorrhœa is a fruitful source of vesical irritability. The inflammation which characterizes this disease is often suddenly transferred from the urethra to the neck of the bladder, giving rise to frequent micturition, tenesmus, and severe pain in passing the last drops of urine, which are occasionally mixed with blood or pus.

Irritability occasionally results from *congestion* of the neck of the bladder, the prostate gland, and the seminal vesicles. These organs, like other parts of the body, are liable to impeded circulation, or stagnation of blood, causing simply turgescence of the vessels, and morbid sensibility of the mucous membrane. The condition is similar to that of the retina in certain forms of amaurosis, and most commonly occurs in robust, plethoric subjects, between twenty and forty years of age. It is characterized by a feeling of fulness in the perineum, almost uninterrupted micturition, and smarting of the neck of the bladder, with a scalding sensation of the urethra. Sometimes the patient is conscious of a strong throbbing in the parts. These symptoms, which are always aggravated by exercise, and even by the erect posture, are liable to be renewed by the slightest

¹ A Practical Treatise on Urinary Diseases, p. 166. London, 1823.

exposure to cold, by a full meal and a few glasses of wine, by drastic purgatives, and by venereal excesses.

2. Irritability of the bladder is frequently induced by an altered state of the *urine*, which produces nearly the same effect upon the bladder as a foreign body. The fluid is generally more or less acid, dark-colored, and strongly disposed to become ammoniacal. It often deposits a copious sediment of mucus, is unusually scanty, and is speedily decomposed after being voided. This form of irritability is most common in elderly subjects, particularly such as are predisposed to gout, rheumatism, and gravel. Males are more liable to it than females. The disease is usually associated with disorder of the general health, which is, doubtless, the immediate cause of the altered state of the urine upon which it depends. The most prominent symptoms are dyspepsia, constipation, capricious appetite, sour eructations, coldness of the extremities, dryness of the skin, soreness in the lumbar region, neuralgic pains in various parts of the body, and a sense of burning in the urethra. In protracted cases, the altered secretion is sometimes directly dependent upon a morbid condition of the kidney.

3. An irritable state of the bladder sometimes results from the use of *diuretics*. The article most liable to produce this effect is cantharides. When taken internally, in an excessive dose, it acts promptly upon the urinary organs, causing great distress at the neck of the bladder, with burning of the urethra, and the most urgent desire to void the urine, which comes off drop by drop, usually tinged with blood, and accompanied by severe spasm and straining. These symptoms are generally attended by the most violent erections. Exhibited in smaller quantities, the effects are more mild, but hardly less persistent, and, in the aggregate, less distressing. Nitrate of potash sometimes acts with extraordinary power upon the urinary apparatus. I have known an overdose produce effects upon the bladder very similar to those of cantharides, and scarcely less severe. When administered for a long time as a diuretic, it seldom fails to irritate the neck of the bladder, and occasion frequent micturition. Vesical irritability is often induced by the use of stimulating drinks, fruits, and vegetables, causing an excess of acid in the urine, with a morbid sensibility of the mucous membrane.

4. *Venereal excesses*, whether in the form of frequent coition, masturbation, or involuntary losses, are exciting causes of this affection. There is not a practitioner of any experience who has not met with

cases of this kind. I have myself witnessed many. In the following case, which I give on account of the well-marked character of the symptoms, the disease was the result of onanism. It occurred in my private practice, in a youth of seventeen years of age, from Monroe County, in the State of Indiana. In the autumn of 1847, he was seized with irritability of the bladder, attended with frequent inclination to pass water, soreness of the urethra, and itching of the prepuce. The affection gradually increased, and when he visited me in October, 1849, he was obliged to urinate from ten to twenty times daily, while at night, after going to bed, he was perfectly free from suffering. He had, on an average, a seminal emission every forty-eight hours, which he often excited by artificial means. Suspecting he might be laboring under stone, I sounded him twice, but was unable to detect any foreign body. The instrument, as it passed along the urethra and the neck of the bladder, caused exquisite pain, and a violent erection of the penis. His general health was much impaired; he was very thin; the pulse was languid; the extremities were cold; the tongue was heavily furred; the appetite was bad; and the bowels were habitually constipated. In short, he had the aspect of an onanist, and all the symptoms of a dyspeptic. A few brisk cathartics, two cauterizations, and the use of sulphate of quinine and iron, soon relieved the poor fellow both of his vesical and seminal troubles.

In *boys*, a degree of irritation about the bladder is sometimes produced by an extremely long and narrow prepuce. The existence of this malformation usually prevents the ready escape of the urine, in consequence of which the edges of the foreskin become inflamed and sore, causing frequent desire to pass water, accompanied with severe pain and even spasm.¹

¹ "I have known in children," says Mr. Coulson, of London, "a contracted state of the prepuce cause irritability of the bladder. A striking case of this kind occurred to me some time ago: The boy, seven years of age, had, for the previous eight months, complained of a frequent desire to make water, attended with difficulty in passing it, and pains round the lower part of the abdomen. On examining the prepuce, I found it so contracted as scarcely to admit the point of a probe. I immediately removed the end of the prepuce by circumcision. From that time the symptoms subsided, and the child recovered. Again, a boy, eleven years of age, had suffered during two or three years from pain in making water, and incontinence during the night. He became my patient. I found the prepuce as contracted as in the previous case. The boy was treated by simple division, and all symptoms vanished. In these cases, the division or removal of the extremity of the prepuce suffices for the cure of the complaint."—*The Diseases of the Bladder and Prostate Gland*, by William Coulson, Esq., p. 91. London, 1852.

5. Disorder of the *digestive* apparatus is capable of producing this disease. The sympathy which exists between the stomach and urinary bladder is familiar to every physiologist and pathologist. There are few confirmed dyspeptics who are entirely free from this disease. The digestive powers of such persons are habitually enfeebled; the stomach is sour and flatulent; the bowels are costive; and the urine is scanty, high-colored, and surcharged with lithic acid, or lithate of ammonia. We have already alluded, under another head, to the changes which this fluid undergoes in consequence of the use of stimulating drinks, high-seasoned food, fruits, and vegetables, and it is, therefore, unnecessary to discuss the subject on the present occasion.

An irritable state of this organ is sometimes produced by the presence of *ascarides*, hardened feces, foreign bodies, hemorrhoidal tumors, carcinomatous disease, ulceration of the mucous membrane of the rectum, organic stricture, anal fistule, and prolapsion of the bowel. Pruritus of the anus, nates, and perineum, may also give rise to it. The irritation in these cases is often excessive, and closely resembles that produced by stone in the bladder.

A very interesting and instructive case, in which the irritability of the bladder was occasioned by the presence of a *tape-worm*, was related by Mr. Tuffnell, in the *Dublin Medical Press* for February, 1848.¹ The patient, a man of temperate habits, had enjoyed good health until three months ago, when he began to suffer from dyspepsia, with hemorrhoids and uneasiness in the rectum. The symptoms gradually increased, and were followed by tenesmus and frequent calls to make water, which was voided in a twisted jet, and accompanied by severe straining, but no pain. Opiates afforded temporary relief, but he became emaciated, and his health suffered severely. A tight stricture, probably the result of a previous gonorrhoea, occupied the membranous portion of the urethra, and the urine, which was highly acid, was loaded with lithate of ammonia. The prostate was of the natural size, but very sensitive to the touch. Mr. Tuffnell prescribed rest in the recumbent position, purgation with castor oil, warm water enemata night and morning, and the internal use of infusion of calumba with tincture of hyocyanus. Under this treatment, the improvement was so rapid that the man resumed his usual habits at the end of a week. His symptoms, however, immediately recurred, and were as immediately

¹ Ranking's Half-Yearly Abstract, January to June, 1848, p. 77.

relieved by the former treatment. A second speedy recovery was effected, but he returned in a few days, suffering as severely as ever. The irritation about the anus had now greatly increased, and he was observed at the same time to be frequently rubbing his nose, which suggested the idea of the possible presence of worms in the intestines. A purgative of turpentine and castor oil was accordingly administered, and the following morning a tape-worm, measuring thirty feet, was evacuated. All the former symptoms immediately subsided, the urine became clear and natural, and the general health was soon permanently restored.

6. An irritable state of the bladder is occasionally dependent upon lesion of the *nervous system*. Many years ago I attended the late Mr. Wright Smith, of Cincinnati, on account of concussion of the spinal cord, produced by a fall upon his lumbar region from a wine cask. The most prominent symptoms, during the first three days, were disorder of the intellectual faculties, and an almost incessant inclination to void the urine, which was remarkably copious and limpid. As the concussion subsided, the desire became less frequent, and the fluid gradually resumed its normal characters. Similar effects are often noticed in injuries of the vertebral column and organic disease of the spinal cord, attended with partial paralysis of the bladder. The urine, in such cases, is always exceedingly acrid, high-colored, offensive, surcharged with glairy mucus and gritty matter, and passed with preternatural frequency.

A considerable degree of morbid sensibility of the bladder is sometimes produced by congestion of the *brain*, or nervous exhaustion, brought on by mental fatigue, or inordinate excitement. Cases of this description, which are not by any means infrequent, are most common in elderly men, of sedentary habits, and of a nervous, excitable temperament.

Mere *mental* emotion will occasionally induce the affection, as a violent paroxysm of fear, grief, or anger. Again, an irritation seated in a remote part of the body has been known to give rise to it. Pinel saw an instance of it, caused by disease of the thyroid gland.

Irritability of the bladder has sometimes been induced by the habit of too frequent micturition. The urine is the natural stimulus of the organ, and if this is too often withdrawn, a certain degree of intolerance is apt to be engendered. The organ, under the influence of this habit, gradually diminishes in size, the muscular fibres are thickened, and the mucous membrane becomes so sensitive as to be

unable to bear the slightest distension. Literary men often suffer in this way, especially if they are dyspeptic, or predisposed to gout and rheumatism.

There is a form of vesical irritability, very common in *young girls*, soon after the age of puberty, which may be appropriately included under the present head, though, as it respects its origin, it is probably of a mixed character. The affection is generally associated with spinal irritation, and dysmenorrhœa, or imperfect menstruation. The extremities are cold, the bowels constipated, the tongue coated, the appetite impaired, and the digestion languid and difficult. The patient, moreover, is flatulent, nervous, and troubled with palpitation of the heart, the action of which is hurried by the slightest agitation and exertion. The disease frequently lasts for years, and sometimes during the greater part of life.

7. Among the causes of this disease may be mentioned any considerable and long-continued *debility*, such as occurs from immoderate venery, spermatorrhœa, onanism, hemorrhage, and chronic diarrhœa.

It is occasionally a sequel of typhus, typhoid, and other fevers, especially when the disease has been very protracted, or treated too energetically. Grief, anxiety, and other depressing passions, terminating in derangement of the secretions and in loss of tone of the stomach, not unfrequently, as was before remarked, produce irritability of the bladder.

8. Exposure to *cold*, or sudden suppression of the cutaneous perspiration, is sometimes followed by this affection. This is occasionally noticed in persons who, after having been immersed for a long time in a hot atmosphere, suddenly go out into the open air in a cold winter day. The first effect of such a transition is a chilly state of the surface, and an arrest of the perspiration, which are often succeeded in a few moments by a desire to void the urine, so urgent as hardly to admit of any delay. Exposure to the rays of the hot sun is capable of rendering the bladder temporarily irritable. I have seen several instances in which the disease appeared to have been thus induced. The patients were all field laborers, and had been engaged at hard work in intensely hot weather; the affection was characterized by an incessant inclination to micturate, by excessive scalding at the neck of the bladder, and by a sense of general prostration, lasting several hours before it could be relieved.

9. Finally, an enlarged ovary, a displaced, gravid, or diseased uterus, or a morbid growth of the pelvis, may occasion symptoms

of vesical irritability. The effect may be purely sympathetic, or it may be caused by pressure on the bladder. Accoucheurs are well aware of this occurrence, of which I have seen several well-marked examples. The affection is most common in old and middle-aged females, though it may take place at any period of life. It is singular that the local suffering is, in many cases, confined wholly to the bladder, while the organ originally and mainly affected is free from irritation. The disease, in this respect, strongly resembles coxalgia, in which most of the pain is felt in the knee, and not in the hip, the seat of the morbid action; and it clearly points out the importance of carefully ascertaining, in all obscure cases, the condition of the pelvic viscera, particularly of the uterus.

Pathology.—From what has been said respecting the causes of this affection, it is not surprising that so little should be known about its pathology. As the disease, in its idiopathic form, never of itself proves fatal, opportunities of ascertaining, by dissection, the exact condition of the parts, are exceedingly infrequent; and in the few cases in which they have been afforded no satisfactory results have been observed. The most plausible conclusion, perhaps, in the absence of positive facts, is that the complaint consists in an exaltation of the nervous sensibility of the mucous membrane, similar to what is occasionally witnessed in the retina, the fauces, urethra, and other mucous canals. What strengthens this opinion is the fact that it is frequently connected with a weak, scrofulous state of the constitution; and that, when this is the case, it generally resists every mode of treatment that has yet been devised for its relief; affording thus an analogy, and that a very striking one, to certain forms of strumous ophthalmia, alike distressing to the patient and troublesome to the surgeon. The bladder, in the more confirmed stages of the affection, is much contracted, but its coats, instead of being thickened, are generally preternaturally thin, and remarkable for their pallor.

When the complaint depends upon local causes, as stone in the bladder, stricture of the urethra, or enlargement of the prostate gland, the anatomical changes are more distinct, and afford a more satisfactory solution of the real nature of the case. Under such circumstances, there are always, or nearly always, evidences of inflammation or congestion of the lining membrane and hypertrophy of the muscular fibres, with alteration of the secretions, and, in some instances, slight deposits of lymph.

Very frequently, as was previously remarked, the irritability is

purely sympathetic, depending upon lesion of some neighboring organ, as the kidney, seminal vesicle, anus, uterus, stomach, or bowel. I have already alluded to an instance in which it seemed to have been produced by a diseased condition of the thyroid gland; and the fact that it is occasionally excited by congestion or organic lesion of the brain, independently of any appreciable structural change of the bladder, is familiar to every pathologist.

Prognosis.—The prognosis of this affection is influenced by so many contingent and concomitant circumstances, that any remarks that may be made respecting it must of necessity be vague and indefinite. This will not appear strange, when we take into consideration the great number and variety of causes by which it is induced and maintained. The idiopathic form of the complaint, although frequently very obstinate, generally, after a time, yields to a well-directed course of treatment. When the disease occurs in weak, scrofulous subjects, it is always remarkably intractable, frequently lasting for years, or ending, perhaps, only with life. The irritation of the bladder of young children, attended with nocturnal incontinence of urine, sometimes disappears spontaneously towards the approach of puberty, while at other times it is exceedingly rebellious, and successfully resists the most judiciously devised means of the physician to overcome it. Hysterical irritability seldom continues long, though it is not always readily amenable to treatment.

When dependent upon local causes, of a curable nature, prompt relief may generally be obtained. All, in fact, that is necessary, in such cases, is to remove the source of the irritation, and the disease will subside of its own accord. Under opposite circumstances, however, the complaint is commonly irremediable, however judicious and well-directed our efforts to combat it. Thus, nothing can be done, with any reasonable hope of success, for a case of irritability of the bladder, caused by carcinoma of the rectum, an enlarged ovary, or a tubercular kidney; and so of many other forms of the disorder.

Treatment.—In entering upon the treatment of this complaint, so Protean in its character, a strict inquiry should, in every instance, be instituted into its origin, which, as has been already seen, may be either sympathetic, nervous, congestive, or inflammatory; and the practice regulated accordingly; otherwise the physician will only be likely to harass his patient, and employ means which can lead to no beneficial result. Indeed, it may be confidently

affirmed that there is no class of diseases which demand a more thorough investigation to enable him to form a correct judgment upon the parts primarily affected than this. The truth of this remark is fully borne out by the long catalogue of causes under the influence of which this disorder is developed, and which no one can read without being impressed with the importance of a most profound knowledge of the physiology and pathology of the urinary apparatus.

The exciting cause of the complaint having been ascertained, the first thing to be attempted is, if possible, to remove it. Strictures must be relieved by the bougie, knife, or caustic, calculi extracted from the bladder, hypertrophy of the prostate reduced, and all sources of local irritation dried up. When the irritability depends upon congestion or inflammation, the application of leeches to the perineum, the hip-bath, and, in plethoric subjects, venesection, are indicated. Purgatives, rest in the recumbent posture, low diet, the internal use of balsam of copaiba, anodyne injections, and demulcent drinks, should not be neglected. In that form of the complaint which arises from organic disease of the kidney, ureter, or bladder, no mode of treatment yet devised does much good. The affection here is strictly symptomatic, and usually lasts, in spite of all that can be done for its relief, until the malady upon which it depends is cured, or the patient dies.

If the disorder depend upon an altered state of the *urine*, the practice must be regulated accordingly. In all cases of an obscure nature, or where there is reason to believe that this fluid exerts such an agency, a careful inquiry must be made into its character, by the employment of the usual tests. If it be found to be red, scanty, and acid, alkalies will be indicated, and the one which I usually prefer is the bicarbonate of soda, either alone, or in union with the bicarbonate of potassa. From fifteen to thirty grains, dissolved in two ounces of plain water, and taken an hour after meals, is a proper average dose for an adult. Occasionally the alkali is advantageously combined with a strong infusion of *uva ursi* and hops. Hickory lye, calcined magnesia, and oxide of bismuth are sometimes useful, though rarely to be depended on. If, on the contrary, the urine manifest an alkaline reaction, acids will be required, such as the nitric, muriatic, and sulphuric, of which the first deserves the preference. I have seen the disease sometimes promptly disappear under the use of the muriated tincture of iron. I have found the article most useful in irritability of the

bladder, attended with a weak and languid state of the digestive organs, coldness of the extremities, and great pallor of the countenance.

If the patient be of a *rheumatic* or gouty habit, colchicum will be useful, and may be exhibited alone, or in combination with morphia and nitric ether. The best form of exhibition is the acetous extract, of which two grains may be given every twelve hours. The urine in these cases is generally red, and charged with lithic acid, on which account it is often necessary to interpose alkaline remedies. Active cathartics, a restricted diet, the warm bath, and topical bleeding will also be proper in persons of this description. In obstinate cases, the exhibition of mercury, carried to slight ptyalism, will be advantageous, and promptly arrest the irritability of the bladder.

When the disease has been induced by the improper employment of *diuretics*, a discontinuance of the remedies, demulcent drinks, the hip-bath, hot fomentations, and a full anodyne by the mouth or rectum, will, in general, put a speedy stop to it.

All *venereal* excesses must be abandoned, and means taken to improve the disastrous effects produced by them. Of these, the most important are quinine and the chalybeate tonics, blue mass and rhubarb, as a purgative, a light but nutritious diet, cold ablutions, the cold shower-bath, and exercise in the open air. If spermatorrhoea be present, nothing short of cauterization will be likely to answer, and should be practised with the least possible delay. By the use of this remedy we cure both the seminal discharges and the irritability of the bladder. When the irritability depends upon a long and narrow prepuce, the proper treatment will be circumcision. When the part, however, is merely contracted, without any particular elongation, simple incision may suffice.

When the irritation has arisen from disorder of the *digestive organs*, particular attention should be given to the correction of the secretions: the diet should be carefully regulated, and the bowels should from time to time be duly evacuated. If dyspeptic symptoms, with acid eructations, are present, tonics, such as quinia and the milder preparations of iron, alkalies, change of air, and sea-bathing, are indicated. Attention to the diet is of paramount importance in all cases of this kind, and is sometimes of itself almost sufficient to effect a cure. Subacid fruits, the coarse varieties of vegetables, coffee, strong tea, pastry, fresh bread and biscuit should be studiously avoided, on account of their tendency to produce in-

digestion, flatulence, and pain in the bowels, with alteration of the urinary secretion. For the same reason, porter, ale, cider, sherry, and Madeira, are usually hurtful. Sometimes an almost purely milk diet does better than any other; and occasionally I have known a patient to be much benefited by the use of a little good French brandy or Holland gin two or three times a day.

If symptoms of worms be present, *anthelmintics* are indicated, of which calomel, spirits of turpentine, and chenopodium are the most valuable. In those forms of the complaint which are dependent upon the presence of piles, ulcers, fistule, or other organic changes of the rectum, anus, or circumjacent parts, there can, of course, be no hope of relief without striking at the root of the evil. Tumors must be removed, ulcers cauterized or incised, and sinuses laid open, and then the vesical irritation will usually be short-lived.

Lesion of the *brain* and spinal cord, leading to irritability of the bladder, must be treated upon general principles. The great indication here, as in other forms of the disorder, is to ascertain the nature of the exciting cause, and then to regulate our practice accordingly. It is impossible, where the causes of a disease are so numerous, to speak, under separate heads, of the treatment adapted to all its different forms.

In that variety of vesical irritability which is so common in *young girls* at or soon after the age of puberty, and which, as was before stated, is probably of a mixed character, depending, perhaps, partly upon spinal irritation, and partly upon disorder of the uterine functions, much benefit will be derived from a proper regulation of the bowels, chalybeate tonics, particularly Griffith's compound iron mixture, Plummer's pill, the shower-bath, and daily exercise in the open air. In protracted and obstinate cases, the uterus must be explored with the speculum, and any disease that may be found must be treated according to the principles laid down by writers on female complaints. The slightest congestion, the most trifling displacement, or the smallest possible ulcer of this organ has been known to maintain the bladder in an irritable condition for months and even years, the general health being in the mean time perfectly wretched, and life hardly worth possessing.

When the disease depends upon *general debility*, the patient must be put upon an invigorating diet, nutritious drinks, tonics, and other appropriate means for improving and confirming the general health. The principles of treatment, under such circumstances, are self-evident, and need not be enlarged upon in this place. In weak,

scrofulous subjects, trial should be made of iodine and its different preparations, especially iodide of iron and iodide of potassium; the disease, however, is generally exceedingly obstinate, and all efforts to arrest it prove unavailing.

If the disease has been induced by *cold*, and the patient is robust and plethoric, venesection, carried to syncope, will generally afford prompt relief, especially if it be aided by a brisk cathartic, anodyne injections, hot fomentations, and a diaphoretic draught, as, for example, a combination of antimony and morphia, or a full dose of Dover's powder. There are few cases of this kind of vesical irritation which resist this treatment beyond a few hours.

Irritability of the bladder, dependent upon an enlarged *ovary*, the existence of a pelvic tumor, or a gravid uterus, seldom, if ever, admits of relief. All that the practitioner can do, in any case of this kind, is to palliate the suffering by the use of anodynes, by a proper regulation of the diet and bowels, and by strict attention to the general health. When the disease is symptomatic of malposition of the uterus, a radical cure may frequently be hoped for, even when the displacement is considerable and of long standing.

There are certain remedies that have sometimes been advantageously used in the treatment of this affection, which, as they do not admit of special classification, may be briefly mentioned here. Among these is the *extract of belladonna*, administered internally, or applied in the form of a plaster, an ointment, or a solution. In my own practice, I have found this substance most useful in that variety of the complaint which is attended with neuralgic symptoms, or sharp, darting or shooting pains in the region of the bladder and pelvis. It may be given in doses from the fourth to the sixth of a grain three times a day, alone, or in union with other articles, its effects being carefully watched lest it prove injurious. A belladonna plaster is an excellent adjuvant in this class of cases; it should be made of the pure extract, spread upon soft leather, and applied warm. The most eligible regions are the sacrum and the hypogastrium. Sometimes I employ a strong ointment of belladonna, composed of two drachms of the extract to six drachms of lard, with the addition of fifteen grains of strychnine. This is rubbed thoroughly, twice a day, upon the perineum, sacrum, and lower part of the abdomen. An opiate plaster often answers an excellent purpose.

I have already incidentally spoken of the *balsam of copaiba* in the treatment of this affection. The remedy is particularly applicable to

irritability dependent upon the extension of gonorrhoeal inflammation, vesical catarrh, and organic disease of the kidney. It should be administered in small doses, three or four times daily, suspended in mucilage of gum Arabic.

Tincture of cantharides has often been beneficially employed in this disorder. I have exhibited it with marked advantage in several cases during the last few years, and equally flattering results have been obtained from it by other practitioners. I have found it most reliable in the irritation of the bladder in young children and hysterical girls, when carried to the extent of slight strangury. As soon as this effect passes off, there is generally a very decided improvement, which, under the subsequent continuance of the remedy, in smaller doses, finally eventuates in a complete cure. Where a tonic is at the same time indicated, the cantharides may be exhibited along with the muriated tincture of iron, or Griffith's compound iron mixture.

Brodie, Coulson, and others speak in very flattering terms of the *buchu* and *pareira brava* in the treatment of vesical irritability. Although I have frequently employed these articles, both alone and variously combined, either with each other, or with other remedies, I cannot recall a solitary instance in which they seemed to afford any permanent benefit. Nor can I make any better report of cubeba.

Hypericæ oil has occasionally been employed with happy effects when everything else has failed. The dose is from ten to twenty drops two or three times a day, in mucilage of gum Arabic, or sugar and water. Dr. Physick was in the habit of prescribing, with decided success, in this affection, the saturated tincture of pokeberries—*phytolacca decandra*. He gave it in two-drachm doses every seven or eight hours.

Dr. Gibrin, a French physician, has detailed, in the *Bulletin de l'Académie de Médecine*, for March, 1837, several cases of irritable bladder, evidently dependent upon chronic inflammation, in which he succeeded in effecting a cure with a *decoction of soot*. The symptoms were occasional retention of urine, pain in the hypogastrium, and a frequent desire to make water, which was turbid, fetid, and mixed with mucus, and sometimes even with blood. Having tried various modes of treatment without benefit, he had recourse to the above article, prepared with two ounces to the pound of water. It was filtered through paper, and injected into the bladder twice a day. Good effects almost immediately followed the administration

of the remedy. The pain ceased, the patient's sleep returned, the urine gradually resumed its normal appearance, and the bladder regained its accustomed tolerance.

Washing out the bladder with tepid water is an old remedy in this affection, which has occasionally, though rarely, afforded relief. The same may be said of anodyne and astringent injections.

SECTION II.

NEURALGIA OF THE BLADDER.

One of the most singular maladies of the urinary bladder is neuralgia, or, as it is usually denominated, *tic douloureux*. As the name imports, it is a nervous affection, characterized by severe suffering, which is generally referred to the neck of the organ, and is distinctly paroxysmal in its attacks, recurring daily, or every other day, about the same period. Formerly, neuralgia was supposed to be peculiar to the branches of the fifth pair of nerves, or, in other words, to have a purely facial locality. More recent investigation has shown that it may exist in other parts of the body, and there are few practitioners, especially in the Western States, who have not witnessed examples of it in the principal viscera. I have noticed it in the eye, stomach, bowels, uterus, spinal cord, testicle, urethra, and urinary bladder. As occurring in the latter organ, a full digest of the existing state of the science is still a desideratum.

Symptoms.—In the early stage of this disease, the symptoms are frequently vague and ill-defined. At first, there is merely a sense of uneasiness in the perineal region, accompanied with a sharp, darting, or tingling pain, recurring only at long intervals. Sometimes, in addition to the shooting pain, there is an unpleasant aching, with a feeling of numbness. In this manner three or four days may elapse before the disease attracts any particular attention. By degrees the attacks become more frequent, as well as more severe, and assume a decidedly periodical character, returning about the same hour every day, generally early in the evening or towards morning. The paroxysms vary in their duration from two to six hours, and, while they continue, the suffering is often of the most racking and agonizing nature. The pain, which is commonly of a sharp, stabbing, darting description, is distinctly referred to the neck or inferior part of the bladder, and bears a very exact resemblance to that produced by a fit of the stone. In most cases it extends to the

neighboring organs, as the rectum and anus, the urethra, and the inside of the thighs. In the female it is occasionally reflected upon the uterus, and in the male along the course of the spermatic cords. In both sexes it is generally very severe in the sacral and lumbar regions. Coincident with this is a sensation of heat and burning in the urethra, with a frequent desire to make water, which is always attended with difficulty. The burning or smarting is particularly distressing at the extremity of the penis, from which it frequently extends to other parts, as the pubes, groin, anus, or sacrum. The urine is thrown out in jets, or the stream is suddenly arrested, and the smaller the quantity in the bladder the greater is the suffering in voiding it.

The paroxysm generally goes off gradually, leaving no other inconvenience than a sense of soreness or aching in the neck of the bladder, perineum, and posterior part of the urethra. During the intermissions the urine is voided without difficulty, and the patient feels comparatively comfortable, almost as well, indeed, as if he had not suffered any pain. When the attacks assume the quotidian type, they usually occur, as was before intimated, in the evening, during the night, or early in the morning. Occasionally they make their appearance soon after eating, and in a few instances they have been known to recur twice in the twenty-four hours; thus leaving the poor sufferer scarcely a moment free from pain.

Fever rarely accompanies this affection, however obstinate or protracted. The appetite is variable and capricious, the stomach is teased with flatulence, digestion is bad, and the patient feels uncomfortable after eating. The bowels are disposed to be torpid, and require to be regulated by medicine. The sleep is interrupted and unrefreshing; the pulse, which at first is not perceptibly altered, becomes quick and irritable; the feet and hands are habitually cold; the general health gradually declines; and the countenance wears an anxious, haggard look. In obstinate cases, there is a discharge of thin gleety matter from the bladder, with great soreness in the perineum and hypogastric region. Another symptom which is occasionally present is a sense of coldness in these parts, which frequently extends to the groin and inner parts of the thighs, and is almost constantly accompanied with some degree of numbness. The urine is almost always natural, both in regard to quality and quantity, except in gouty and rheumatic subjects, in whom it is generally acid, scanty, and intermixed with red sand.

Diagnosis.—The diagnostic signs of this disease are not always

very distinct. We have already remarked that the attacks, especially when very severe, bear the closest resemblance to the paroxysms produced by calculous concretions, and it will be presently seen that they are frequently associated with, if not dependent upon, other affections. Hence it is not always easy by any means to form a correct opinion respecting the true nature of the case. In doubtful circumstances, sounding of the bladder is advisable, and should never be omitted; but even this does not always answer the purpose. In the case of a young female, mentioned by the late Dr. Parrish, of Philadelphia,¹ the symptoms of vesical calculus were so strongly marked that she was repeatedly sounded by the different surgeons of the Pennsylvania Hospital, and that excellent practitioner even proposed dilating the urethra with sponge-tents, in order to introduce the finger into the bladder the more satisfactorily to ascertain its real condition. Various expedients were resorted to without relief, and she finally sank under an attack of dysentery. On inspection, no trace of disease was anywhere discoverable, excepting in the bowels. The bladder contained no stone, and the whole urinary apparatus exhibited a perfectly normal appearance. Mr. Rowland observes that the operation of lithotomy has sometimes been performed in neuralgic affections of the bladder, under an erroneous opinion as to the nature of the case.² On the whole, the most important signs, perhaps, are the paroxysmal character of the disease, the sharp and darting pains, the uncomfortable itching and scalding in making water, the attempts at which are very frequent, urgent, and difficult, and the numbness of the perineum, scrotum, groins, and thighs.

Causes.—Of the causes of vesical neuralgia very little is known. In general, indeed, they are wholly inappreciable. It is often, as was previously stated, associated with disease of the neighboring organs, but how far it is influenced by, or dependent upon it, it is impossible, in the present state of our knowledge, to determine. In the case of Dr. Parrish, just alluded to, it was complicated with obstinate amenorrhoea and occasional vomiting of blood, but no cause could be assigned for the neuralgic affection of the bladder, which was excessively severe, and of several years' standing. In some instances, it has been known to supervene upon parturition, to continue for several months, and then totally disappear. It is observed, for the most part, in persons of a nervous temperament, and

¹ *Practical Observations on Strangulated Hernia*, p. 312. Philadelphia, 1886.

² *Treatise on Neuralgia*; Dunglison's Medical Library, p. 265. 1839.

in those who are subject to the same malady in other regions of the body. Venereal indulgences, masturbation, stricture of the urethra, stone in the bladder, organic disease of the uterus, and hemorrhoidal affections, are all capable of exciting it. Habitual constipation of the bowels, dyspepsia, mental emotions, and a depraved condition of the urinary secretion, are also circumstances which favor its production. What influence, if any, miasm exerts upon its development is not ascertained. Judging from what we know of this malady as it occurs in other parts of the body, it is without doubt a very frequent cause. An elderly gentleman whom I attended several years ago, was subject to neuralgic attacks of the bladder and right knee, which generally lasted eight or ten days at a time, then disappeared and recurred about once every three months. In early life he had been severely affected with rheumatism, and a short time before the vesical neuralgia came on he had labored under intermittent fever, which left him with an enlarged and indurated state of the spleen.

Period of Life.—Neuralgia of the bladder is not confined to any particular period of life, though the old and middle-aged are without doubt most subject to it. Nor is it peculiar to the male sex. Women not unfrequently suffer from it, but in what proportion is a point concerning which we are still ignorant. Nor are we any wiser in regard to the influence of occupation or mode of life. In respect to both these subjects our data are too imperfect to enable us to arrive at any satisfactory conclusions.

Nature.—What the nature of this malady is, is a point respecting which we are still entirely ignorant. As the name imports, it would appear to be a nervous disorder; but whether it is really seated in the nerves, in the mucous coat, or in the muscular fibres of the bladder, has not been determined. Dissection has thrown no light on this interesting and intricate subject, and the question as to its real seat must therefore, for the present, remain unsettled.

Prognosis.—Vesical neuralgia, although an exceedingly painful and distressing disease, seldom terminates fatally. In many cases, perhaps the majority of them, it is remarkably obstinate, and persists for weeks or even months, in spite of the best-directed treatment; on the other hand, instances occasionally occur which disappear almost as suddenly as they come on. This is especially the case when the disease has a miasmatic origin, or when it supervenes upon intermittent fever. Occasionally it continues with but little intermission for several years, thus undermining the general health, and laying the foundation of serious and irreparable mischief.

Treatment.—It is obvious, from what has been already stated, that the treatment of this affection must be regulated by the causes by which it is induced. As these are generally obscure, or entirely inappreciable, the practitioner is frequently obliged to grope about in the dark, and employ various measures before he finally succeeds in hitting upon one that is attended with any benefit. When the disease is connected with an inflammatory state of the system, as it is occasionally found to be, prompt and efficient *bloodletting* is the remedy upon which, in the commencement, our hopes of success must be mainly placed. The first bleeding should be carried to the extent of producing a decisive impression on the system, and the operation should be repeated every day or two until the violence of the paroxysm has abated. When the disease assumes a chronic character, the abstraction of blood from the arm will not be required oftener than once a fortnight, or three weeks. In many cases nothing is found to answer so well as the plan we are now considering, both in neuralgia of the bladder and of other parts of the body. With regard to local bleeding by leeches, not much can be said in favor of its utility. Where there is tenderness in the perineum, the course of the urethra, the sacrum or loins, it may do good by relieving vascular fulness, and sustaining the antiphlogistic impression made by the previous venesection, which in this, as in most other maladies, should be premised, especially in plethoric subjects. The leeches should be applied directly to the seat of the pain, and the bleeding be afterwards encouraged by cloths wrung out of hot water. The same remarks may be made in reference to cupping.

Purgatives are decidedly useful in this affection, especially in that variety of it dependent upon a miasmatic origin, constipation of the bowels, or deranged menstrual action. They are particularly valuable in the early stage of the attack, and should be administered in doses adequate to procure free evacuations. The more drastic articles of this kind, however, should be avoided, as they generally produce serous stools, and frequently do mischief by exciting nausea, vomiting, and tormina. Mercurial purgatives are, on the whole, those from which most advantage may be expected, whatever may be the cause of the disease. In no instance, however, should they be carried so far as to induce salivation, as this has a tendency usually to aggravate the disease, and render it more intractable, although it will occasionally shorten the paroxysms, or even perhaps entirely prevent them for a few days. From ten to

twenty grains of calomel, with one of opium and two of ipecacuanha, should be given at bedtime, followed in the morning by an ounce of castor oil, or a cupful of a strong infusion of senna. After the bowels have thus been thoroughly evacuated, they should be kept in a soluble condition by the milder kinds of laxatives, with an occasional dose of blue pill, say five or six grains every other night. From abundant experience in the treatment of neuralgic affections, as occurring in different parts of the body, I am convinced that a systematic course of purgation is not only unequivocally beneficial, but absolutely indispensable to a speedy and permanent cure. When the disease is complicated with amenorrhœa, the cathartic medicines should be combined with aloetic and emmenagogue preparations, with a view to their specific effects on the uterus.

Much has been said, within the last twenty years, of the beneficial effects of the *carbonate of iron* in the treatment of neuralgic maladies, and there can be no doubt that, under judicious management, it is among our most valuable curative means. Dr. Elliotson, of London, in an able paper on this article, in the thirteenth volume of the *Medico-Chirurgical Transactions*, speaks of it in terms of the highest commendation. It should be given in doses of from one to four drachms every four hours, in twice its weight of molasses, strict attention being paid to the bowels, which should always be kept open during its employment. It need scarcely be added that iron is only admissible in those cases which are unaccompanied with inflammation or organic disease of the stomach or bowels. On the whole, I am disposed to believe that this medicine is far inferior in the treatment of this affection, whether seated in the urinary bladder or in other parts of the body, to quinine and arsenic. These articles, at all events, are much more frequently employed in this country than the iron, and are by many considered almost as specifics. When neuralgia arises from malaria, they are generally sufficient to break up the paroxysms in two or three days, or to modify their character in such a manner as to bring them more readily within our control. After adequate alvine evacuations have been produced by the method already adverted to, with or without general bleeding, the quinine should be administered in doses of about four grains every three hours, until fifteen or twenty grains have been taken. It should then be discontinued until the next day, when it should be resumed, and persevered in until the same quantity has been used. By this time the paroxysms will usually have

abated very much in violence, or perhaps altogether subsided. Some practitioners administer the article in larger but less frequently repeated doses, a method which, although sometimes highly beneficial, is often objectionable on account of the distress which the medicine is apt to produce in the head.

When the disease has been thus moderated or subdued, the best medicines to eradicate it are *arsenic*, strychnine, and aconite, in union with opium. The formula which I have been in the habit of using for many years past, both in vesical and other forms of neuralgia, is the following:—

R.—Acid. arseniosi gr. ij.
Strychninæ gr. j.
Ext. aconiti gr. viij.
Pulv. opii gr. v.—M.

These ingredients should be incorporated with each other with the greatest care, and be divided into sixteen pills of equal size, of which one is to be administered every six hours, or four in the twenty-four hours. In some instances, the opium may be advantageously increased, or, where it disagrees with the patient, it may be replaced by lupuline or hyoscyamus. When nausea ensues, the pills are to be used less frequently, or, instead of giving a whole pill at a dose, only one-half, three-fourths, or two-thirds of one should be employed at a time. Attention to this point is a matter of paramount importance, as it respects the benefit to be derived from this combination. Another rule is, not to continue the exhibition of the pills longer than a week or ten days at a time, to allow the stomach a short recess, when they are to be resumed, and taken as before. When administered with these precautions, arsenic, strychnine, and aconite seldom fail to produce a most favorable impression, and are often, of themselves, sufficient to effect a cure. Where this is not the case, they should be employed along with other remedies, of which purgatives, quinine, and the warm bath are amongst the most efficacious. With Fowler's solution of arsenic, so much vaunted in the treatment of this affection, my experience is limited; but I have given it sufficiently often to satisfy me that it is far inferior, in every respect, to arsenic in substance. It is more liable to nauseate, and does not exert the same controlling influence in arresting the disease.

To moderate the violence of the paroxysm, large doses of *narcotics* are frequently indispensable. Of these the best are the salts of *morphia*, either alone or in combination with nauseants, according

to the state of the vascular system. In some instances, where other means have failed to afford relief, I have derived the greatest benefit from the steady, persistent use of this class of remedies. I might, indeed, cite a number of cases in which their protracted exhibition resulted in a radical cure. My rule is to give narcotics in full and sustained doses, taking care always previously to clear out the bowels and restore the secretions. Where one article, or mode of exhibition, is found to disagree, another should be substituted. When the pain is very violent, or when narcotics cannot be taken by the mouth, opiate injections or suppositories should be used.

An emetic of ipecacuanha or tartrate of antimony, at the approach of the paroxysm, will sometimes have the effect of cutting it short, or materially abridging it. The remedy is particularly indicated when the disease is associated, as it often is in malarious districts, with gastric and biliary disorder.

Much benefit will also accrue, in many cases, from the *warm bath*, or the application of steam to the affected part. This can be readily effected by connecting one end of a gum-elastic tube with the spout of a tea-kettle filled with hot water, and placing the other under the bellithes. Fomentations with hops, opium, or laudanum will also be highly serviceable.

In persons of a gouty, rheumatic habit, who are predisposed to such and in whom the urine is habitually loaded with uric acid, no remedy will be so likely to be successful as *colchicum*. The best form of exhibition is the vinous tincture, in the dose of one drachm as before, in union with half a grain to a grain of morphia. Under the influence of this medicine, aided by an occasional purgative of calomel and rhubarb, the secretions are speedily restored, the urine changes its character, and the gastric functions are improved. When the stomach is oppressed with acidity and flatulence, alkaline liquors should be tried, in the intervals of the colchicum; and a good form for their exhibition is a combination of bicarbonate of soda and potash. An occasional dose of calcined magnesia, to clear out the bowels and neutralize the acid contents of the alimentary canal, will also under these circumstances, prove highly beneficial.

Mons. Civiale, in an able article on vesical neuralgia in the *Gazette Medicale* for July, 1853, states that he has cured many cases of this disease by the repeated introduction of *bougies* into the bladder, on the well-known principle that the contact of a foreign body has a tendency to allay the disordered sensibility of the affected part. The instrument which must be soft and of moderate

size, should be retained for five or ten minutes, and then withdrawn, the operation being repeated daily until it passes without pain. A larger bougie should then be substituted, and in this manner the treatment is to be continued until the morbid sensibility of the mucous membrane of the urethra and the neck of the bladder is completely destroyed. In most cases, observes Civiale, the success of this method is prompt and decisive, though occasionally it fails, or the good effects of it manifest themselves only after a long time. Under these circumstances, he seeks to make a stronger impression with a large-sized catheter, the friction of which will sometimes alone produce a cure.

I must confess my distrust in the remedy of the distinguished French surgeon. In nearly all my trials, and they have been quite numerous, little benefit has resulted, no matter how the operation was performed, whether with a small or large instrument, whether at long or short intervals. Such, in truth, has been the want of my success with this mode of treatment, that I have for some years past entirely abandoned it. The operation, even when performed with the greatest possible gentleness, is sometimes productive of exquisite suffering, and is occasionally followed by an aggravation of all the symptoms. Injections of acetate of lead and opium, or of a watery solution of opium and hyoscyamus, are, I think, in every respect, to be preferred. They are much more soothing to the bladder and urethra, and their administration is almost exempt from pain and inconvenience. They should be employed tepid, cool, or cold, as may be most agreeable to the part and system.

In the more aggravated and intractable forms of the malady, recourse must be had to *counter-irritation* to the perineum, the suprapubic region, the sacrum, or upper and inner part of the thighs. The best forms are the moxa and the caustic paste issue. Tartar emetic pustulation is exceedingly painful, and well calculated to aggravate the local mischief. On one occasion I made trial of the actual cautery, but without any apparent benefit. The case will be mentioned elsewhere.

When the neuralgia depends upon stricture of the urethra, foreign bodies in the bladder, hemorrhoids or other disease of the anus, none but the most transient amelioration can be expected from any mode of treatment until these causes have been removed. The great object of inquiry, therefore, at the very commencement, should be to ascertain, if possible, the source of the irritation, by a careful

[illegible]

upon the use of anti-neuralgic remedies, to sound him; but, after the most careful search, found nothing. The operation was subsequently repeated several times with the same result. Giving him a dose of calomel, rhubarb and jalap, to open his bowels freely, I enjoined a light diet, and ordered him, three times daily, a pill composed of the eighth of a grain of arsenious acid, one-half that quantity of strychnine, and half a grain of extract of aconite, with three grains of quinine. The prescription was continued for a week, when it was temporarily omitted, on account of the disordered condition of the stomach. Meanwhile, little impression was made upon the disease. As soon as the nausea had subsided, the use of the medicine was resumed, but in smaller quantity. In this way another week elapsed, and still the disease went on. Colchicum and morphia were now substituted, and under this combination, aided by the daily use of the hot bath and bicarbonate of soda and hop tea, the symptoms improved, the patient began to have some appetite and sleep, and the micturition diminished considerably in frequency. The amelioration, however, was of short duration. In eight or ten days the symptoms were as violent as ever. The copaiba mixture was now directed, with the addition to each dose of from three to five grains of benzoic acid. Under this prescription, which was continued for several weeks, no amendment was produced. Morphia, in large doses, both by the mouth and the rectum, was next tried, but with no other than transient relief. The original prescription was now resumed, and again used for several weeks with an occasional intermission. A large issue was also established in the sacro-lumbar region with the actual caustery, and the effect of the bougie, as recommended by Civiale, was tried. No relief followed. Finally, anodyne injections were thrown, at first once, and afterwards twice a day, into the bladder; suppositories were also employed morning and evening; and, as a tonic, the patient was directed to take, three times a day, fifteen drops of the mercurial tincture of iron in combination with a drachm of elixir of paregoric. In short, the treatment was varied in every possible form for five or six months, without the slightest permanent, or, in fact, even any decided temporary benefit. Becoming discouraged, the patient finally went home, where, after lingering for six or eight months longer, he sank under the effects of his ailments. No examination of the body was permitted.

CASE 2.—Tumor in the nympha; irritability of the bladder; scalding in passing water; pains in the pelvis, thighs, and perineum; excision of the tumor; speedy recovery.

A married woman, twenty-nine years of age, the mother of three children, visited me in 1846 for neuralgia of the bladder, under which she had labored upwards of four years. She was tall and slender, with a pale, sallow complexion, and was of a nervous, excitable disposition. Soon after her second confinement, she observed a small swelling on the left nympha, a short distance from the orifice of the urethra, which, in time, became exquisitely tender, and gradually acquired the bulk of a pigeon's egg; it was of a red, florid color, and of great firmness. About five months after it was first noticed, it began to pain her, especially late in the evening, so that she was unable to rest well at night; her appetite also declined, the bowels were costive, and she was obliged to void her urine six or eight times in the twenty-four hours. Micturition was attended with a scalding sensation in the urethra and the neck of the bladder, followed, in a few months, by dull, heavy, aching pains, which, at intervals, started through these parts in different directions, as well as through the thighs, the groins, and perineum. She also suffered severely in her back as well as in the thighs and legs; and the little tumor was a source of incessant annoyance. During her last pregnancy, which was terminated about six months previously to her visit to me, her neuralgic pains were greatly augmented, both in frequency and violence; nor did her

confinement bring with it any decided or permanent relief. She had formerly suffered from neuralgia of the facial nerves.

Believing, from the history of the case, that the vesical affection was owing to the tumor above described, I at once excised it, and then placed the patient upon a course of constitutional treatment, under which she rapidly recovered. Indeed, she had hardly any severe neuralgic pains after the operation. The remedies directed for her consisted chiefly of the compound calomel pill, and of the internal use, three times daily, of quinia and the aromatic wine of the citrate of iron, in the proportion of three grains of the former to a drachm and a half of the latter. Her strength and color rapidly improved, the circulation of the extremities was restored, her spirits, which had been previously much depressed, became remarkably buoyant, and, when she left Louisville, after a sojourn of three weeks, she seemed to be the most happy and delighted being in the world.

CASE 8.—Stricture of the urethra; frequent desire to urinate; severe pains in the bladder, loins, thighs, and testes; great disorder of the general health; use of alkalis; cure of the stricture; recovery.

A gentleman, sixty-seven years of age, a judge of a county court, contracted, while a youth, a severe gonorrhœa, from the effects of which he did not recover for several months. When twenty-three years old, he noticed that the stream of urine was much smaller than formerly, and that micturition was attended with a scalding sensation in the urethra and neck of the bladder. Under the use of a bougie, the canal was gradually restored to its former caliber, and the urinary symptoms disappeared. At the age of fifty-nine he again contracted gonorrhœa, which continued, off and on, for nearly eighteen months, and finally left him with a considerable stricture, attended with a frequent desire to void his water, and neuralgic pains in the bladder and pelvic region. He had taken various nostrums until July, 1844, when he came to town, and put himself under my care. His condition at this period was as follows: the pulse was soft, full, and sixty in the minute; the tongue was clean; the bowels were regular, and the passages of a healthy character; the urine was much increased in quantity and rather pale, but of the natural smell and taste; and micturition was always attended with great pain, especially at the neck of the bladder, in the urethra, and at the head of the penis. The calls to urinate were very frequent, particularly at night, and he rarely passed more than a tablespoonful of water at a time. His sleep was disturbed by getting up every half hour. Whenever the bladder was more than ordinarily distended, the pain extended up the loins, along the spermatic cords, and down the thigh, the perineum, and the testicles, the latter of which were exquisitely tender and sensitive. Latterly, he experienced burning sensations in the hands and feet, especially in the evening and early part of the night. His constitution now also began to suffer: he became peevish and fretful, had little or no appetite, and was habitually constipated. A middle-sized catheter passed with great difficulty into the bladder, and created the most intense pain, leading almost to syncope. The morbid sensibility of the urethra was excessive. An organic stricture evidently existed in the membranous portion of the urethra; the prostate gland seemed to be little, if any, enlarged. The instrument failed to detect any foreign body; but its introduction was followed by a discharge of upwards of a pint of pure blood. At least a week elapsed before he recovered from the effects of the operation.

As the general health was greatly deranged, it was evident that no impression could be made upon the local affection until this was improved. The patient was accordingly put upon the use of purgatives, consisting, at first, of calomel and rhubarb, and, afterwards, of blue mass, rhubarb, and Castile soap, with a small quantity of ipecacuanha.

the diet was carefully regulated; a hot bath was directed twice a day; and strict attention was paid to recumbency. Leeches were applied to the perineum; and, although the urine was alkaline, a liberal use of bicarbonate of soda and potash was enjoined. Under this management, in less than a fortnight, the improvement was most striking; appetite and sleep returned, the countenance lost its anxious expression, and the patient was able to retain his water from two to three hours at a time. An attempt was now made to relieve the stricture, upon which, it was evident, nearly all the local suffering depended. The instrument met with less resistance than formerly, and produced comparatively little pain, either in the urethra or at the neck of the bladder. In forty-eight hours, a larger catheter was passed, and in this manner the treatment was continued for the next four weeks, at the end of which time the parts were nearly entirely well. It should have been observed that free use was made, during the greater portion of this time, of uva ursi and hop tea, with soda and potash, the warm bath, porter, and a light but nourishing diet. In a fortnight more, the judge returned to his residence, to resume his official duties. He wrote me several months afterwards, stating that, under the occasional use of the bougie, and the remedies just mentioned, his general health remained good; that he rarely, and then only for a few minutes, suffered from his neuralgic pains.

CASE 4.—Dyspepsia; pain in the urethra, rectum, and thighs; alteration of the urine; distress aggravated by sitting and walking; seminal emissions; failure of treatment.

J. W., of Kentucky, aged twenty-six, a clerk in a dry goods store, of a nervous, melancholic temperament, always enjoyed good health until June, 1849, when he began to suffer from dyspepsia and constipation, attended with neuralgic pain in the right shoulder, which occasionally shifted to the other side, and was always aggravated by exercise, defecation, and exposure to the weather. Soon after this he had sexual intercourse, which was followed, in a short time, by excessive pain in the lower part of the back, and, in about a fortnight, by scalding of the urethra, itching in the head of the penis, and a high-colored state of the urine. These symptoms were speedily succeeded by pain and burning at the neck of the bladder, and a peculiar tingling sensation along the whole of the urethra; darting pain and burning were also perceived in the rectum and the upper and inner parts of the thighs. The urine was feculent and slightly acid, and there was a thin, glairy discharge from the urethra. Occasionally severe strangury supervened, though it rarely continued beyond ten or fifteen minutes at a time. The patient never had any disease of the genito-urinary organs before.

In June, 1850, the patient wrote as follows: "I do not suffer as much now as I did some months ago from strangury, or distress at the neck of the bladder; but the disease of the rectum has greatly increased. I am now unable to walk any distance, or sit on a chair any length of time, without an aggravation of my distress. I am at present troubled with an aching pain in the perineum, anus, and neck of the bladder; and, for the last two weeks, there has been a thin, ropy, mucous discharge from the urethra. I am occasionally annoyed with nocturnal emissions; there is no regularity in their occurrence; sometimes they take place twice a week, and sometimes only once a fortnight; sometimes I escape three or four weeks, and then have two or three in rapid succession. Exercise on foot will produce them in the daytime." I sounded the bladder in this case, but found no stone, stricture of the urethra, or disease of the prostate gland. The operation was productive of severe pain and distress, which did not entirely disappear for five or six days.

It is not necessary to enter into the particulars respecting the treatment of this case. It is sufficient to state that an immense number of articles were used, singly and com-

Leeches were used to remove the blood from the body of the patient. The patient was then placed in a bath of opiate and was maintained for a long time. The patient received a fair amount of rest after a trial of treatment and then a further trial was made. It was found that the patient was able to walk and was able to eat and drink. The patient was then discharged from the hospital.

[illegible][illegible]

the use of bicarbonate of soda and sulphate of quinine, three times a day, a Dover's powder at night, and an occasional dose of calomel and rhubarb, with proper attention to the diet, the vesical trouble rapidly decreased, the urine being voided less frequently and with less pain, and the general health also gradually improved. The sound, introduced late in October, detected, as I supposed, a small calculus, but not being fully satisfied of the fact, I passed the instrument again, on Saturday, November the 16th, before the medical class of the University, with a similar result. Still, I felt that I might be mistaken, for the sensation imparted to my finger was very vague, and I had failed, moreover, to detect the clear metallic click, so characteristic of the existence of stone in the bladder. Some of my friends thought that they had touched a stone, though they could not hear any sound. Soon after the last operation, which, like the first, was performed while the child was under the influence of chloroform, severe cough supervened, the appetite entirely failed, the extremities began to swell, and the vesical irritation greatly augmented, the little patient expressing his suffering by constant moaning and restlessness. Morphia, in liberal doses, was daily required for the purpose of mitigating his distress. Forty-eight hours before he expired he had a severe chill, followed by copious sweats. He died, completely exhausted, on the 20th of November, upwards of two months from the time of his first attack.

I examined the body the morning after death. The bladder contained at least eight ounces of urine, but there was no calculus either in that organ or in the urethra. The investing membrane was entirely sound, as was also the prostate gland. The kidneys were preternaturally vascular, but normal in every other respect. The ureters were unaffected. The abdominal viscera were healthy. The lungs, particularly the left, were deeply congested, but free from hepatization.

The immediate cause of death, in the above case, appears to have been the exhaustion induced by the neuralgic suffering. With the exception of the lungs, which were considerably congested but not inflamed, all the viscera, even the bladder itself, were sound.

SECTION III.

PARALYSIS OF THE BLADDER.

The bladder is destined, in the natural state, to retain the urine for an indefinite period, and then to expel it by the contraction of its muscular fibres, aided by the action of the diaphragm and of the abdominal muscles. When the organ is deprived of this power, it is said to be in a state of paralysis, and the paralysis is either partial or complete, according to the extent of the loss. It is important also to know that the affection may be either essential or symptomatic, or, in other words, that it may be dependent upon causes inherent in the bladder itself, or upon a diseased condition of other parts of the system. Another distinction, long ago recognized by Zubert¹ and other German authors, is into paralysis of the neck of

¹ Diss. de Morbis Vesicæ.—Scemmering, *Traité des Maladies de la Vessie et de l'Utrétre*, p. 69. Paris, 1824.

the organ, and paralysis of its body. This arrangement is of no little practical importance, inasmuch as the first variety of the affection is generally attended with incontinence, and the other with retention of urine.

Causes.—Paralysis of the bladder may result from a great many different causes, a knowledge of which will materially contribute to a right comprehension of the pathology of the disease, and put the surgeon on his guard against a variety of errors. The following arrangement will be sufficiently minute for practical purposes: 1, Paralysis from external injury; 2, from inflammation; 3, from over-distension of the muscular fibres; 4, from disease or injury of the cerebro-spinal axis; 5, from loss of tone of the general system; and 6, from the effects of old age. To each of these varieties it will be necessary to devote separate consideration.

I. Palsy of the bladder sometimes arises from external *violence*. My attention was first prominently directed to this subject nearly twenty years ago, in consequence of being called to a patient, who, in a scuffle with a fellow-laborer, had received a kick upon the hypogastric region, his bladder being at the time full of urine. He was seized soon after with severe pain in the pelvis, accompanied with a stinging sensation along the course of the urethra, and an utter inability to pass a drop of urine. The catheter was introduced twice a day for nearly a week before the organ fully regained its functions. The muscular fibres had evidently experienced a violent contusion, in consequence of which they had lost their power of contraction. The occurrence is generally caused by the passage of the wheel of a carriage, by blows or falls, or by the body being jammed in between two firm and resisting objects, as a post and a wagon. It is sometimes complicated with fracture of the pelvic bones, and occasionally it supervenes upon injury of the perineum. Obstetricians have long been familiar with this form of paralysis, which often follows severe and protracted labor, in consequence of the pressure which the child's head, as it descends into the lower strait, exerts upon the bladder, especially if the urine has not been previously evacuated. A similar effect is sometimes produced by the mal-adroit use of the forceps.

II. Paralysis sometimes accompanies, or rather follows, *inflammation* of the bladder. In mild cases of this description, and in the early stages, the organ is generally extremely irritable, and therefore contracts with increased vigor and frequency, the patient being compelled to void his urine every few minutes. The bladder,

in fact, is in the same condition, as it respects its middle tunica, that the rectum is in dysentery; the muscular fibres are in a state of irritation, and hence there is, in both cases, incessant and painful contraction. In violent cystitis, on the contrary, the muscular coat is overwhelmed by the morbid action, and is consequently no longer capable of performing its office. It is paralyzed just as the small intestine is in acute peritonitis, or the orbicular muscle of the eye in certain forms of conjunctivitis. In this variety of palsy, the patient generally suffers severe pain, and has a constant inclination to void his urine, which is often very turbid, offensive, high-colored, and even bloody.

III. In the third place, paralysis of the bladder may arise from *over-distension* of its muscular fibres. This variety of the affection is most common in advanced life, but may occur at any period, even in the most tender infancy. It is usually produced by a neglect to empty the bladder when a desire is felt to urinate, the patient, perhaps, not finding it convenient at the moment, or for some time after, to obey the promptings of nature. When at length he makes the effort, he is unable to succeed, the muscular fibres having been overstretched, and deprived of their contractile power. In short, they are in a state of paralysis, and the most violent straining is incapable of exciting them; the catheter alone can afford relief. Old men who are in the habit of taking a great deal of exercise on horseback, are very liable to this form of palsy. Instead of dismounting when they experience a desire to urinate, they continue their ride, and when they reach their place of destination, they are frequently unable to pass a drop of water. I have seen quite a number of cases of this kind, some of which have done well, while others terminated fatally, generally within the first five or six days.

IV. The paralysis dependent upon lesion of the *spinal marrow*, the brain, and the nerves which are detached from them, is nearly always associated with paralysis of the inferior extremities. The causes which commonly give rise to this affection, are serous effusions, apoplexy, the presence of tumors, sprains, concussions, fractures, and dislocations. In short, whatever is capable of producing compression of the cerebro-spinal axis, or of the nerves which supply the lower half of the body, may induce the lesion. The paralysis of the bladder, in these cases, may exist in various degrees, from a slight want of muscular power to complete inability. When the affection is confined exclusively to the neck of the organ,

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much more common than is usually supposed, and is unfortunately often overlooked by the professional attendant. From ignorance of the subject, or, what is equally culpable, inattention, much suffering is thus sometimes produced; the primary disease is greatly aggravated, and life is brought into imminent danger. The paralysis may occur at any period of the febrile complaint; but is most apt to show itself in the advanced stages, when there is considerable depression of the nervous system. The first link in the morbid chain seems to be a want of sensibility of the bladder, in consequence of which the urine ceases to make its accustomed impression, and continues to accumulate without awakening any desire to evacuate it. When at length the proper inclination is felt, the muscular fibres will be found to have been so much stretched that they are incapable of fulfilling their office. The patient, lying in a state of stupor, drowsiness, or delirium, is unable to indicate his wants, and thus the distension goes on increasing until the bladder is in danger of bursting. When some degree of sensibility remains, he makes known his suffering by his moans and restlessness, and by placing the hand upon the hypogastric region, by grasping the penis, or by making ineffectual efforts to void his urine. In complete insensibility, he is unconscious of any inconvenience.

Analogous to the paralysis of the bladder now described, is that form of the affection which occasionally supervenes upon compound fractures and dislocations, severe injuries of the lower extremities, wounds of the bowels, strangulated hernia, and contusions of the abdominal muscles. Every surgeon is aware that the bladder sometimes loses its power of contraction after amputation of the thigh and leg, the removal of large tumors, and other important operations. The tying of a hemorrhoidal tumor is occasionally followed by this result. Fifteen years ago I performed an operation of this kind upon a gentleman in Cincinnati; the bladder was completely paralyzed the next morning, and nearly a week elapsed before he was able to pass his water without the aid of the catheter.

Finally, to this class may be referred the palsy which results from inordinate sexual indulgence, and long-continued self-abuse. These causes, by weakening the tone of the system, may induce a corresponding debility of the bladder, and thus render it incapable of contracting with sufficient force to expel its contents. The defect, which is most common in old men, occasionally occurs in young subjects, and rarely exists in a complete degree.

Great torpor of the bladder, amounting to actual paralysis, is

sometimes caused by mere local exhaustion, or temporary arrestation of the nervous influence. Thus, an opiate enema or suppository will occasionally deprive the organ, for several hours and even days, of its muscular irritability. The paralysis, which is generally slight at first, may ultimately, by a continuance of the remedy, become so complete as to require the use of the catheter for the evacuation of the urine.

VI. There is a variety of palsy of the bladder to which the term *senile* may be appropriately applied, as it is almost peculiar to old age. As the body loses its elasticity, the cornea grows dim, and the power of locomotion diminishes, the bladder, participating in the general decay, becomes less sensible to the presence of the urine, and less capable of expelling it. The complaint is most common in elderly men who have led a life of indolence and inactivity, who have indulged freely in the pleasures of the table, and who have habitually neglected the calls of nature. Persons of a gouty and rheumatic diathesis are said to be peculiarly liable to its attacks. There is no mechanical obstruction to the flow of urine, but simply a want of power in the muscular fibres of the bladder, in consequence of which it contracts feebly and imperfectly upon its contents. The paralysis is seldom complete, and usually comes on in a slow, stealthy manner, having already, in most cases, made considerable progress before there is any suspicion of its real character. One of the first symptoms which attracts attention is a slight difficulty in starting the urine; the patient is conscious that he is obliged to make a greater effort; and a longer period is required to complete the evacuation. At the close of the discharge, the water comes away in drops, and a portion often remains in the urethra, from which it issues after the micturition is completed, thus soiling the linen, and causing more or less discomfort. The bladder is never, at any time, entirely emptied, but a small quantity of urine is retained in the inferior part of the viscus, where it becomes a source of irritation, not only to the mucous membrane but also to the muscular fibres. As the disease advances, the muscular contractility is still further impaired; and the water, instead of being ejected in a bold, full stream, falls between the patient's legs; or, to use a vulgar expression, he pisses upon his shoes.

Symptoms.—Whatever may be the cause of the paralysis, or the circumstances under which it takes place, the symptoms which attend it are, in general, sufficiently well marked. As soon as the bladder has lost its power of contraction, its contents accumulate and distend its

walls. The organ, thus pressed upon in every direction, gradually rises above the pubes into the hypogastric region, forming a tumor which ascends sometimes as high as the umbilicus, and as far outwards on each side as the brim of the pelvis. The swelling is of an ovoidal shape, fluctuating, indolent at first, but painful afterwards, and attended with complete retention, which constitutes the characteristic symptom of the affection. After the paralysis has continued for several days, the water generally dribbles off in drops, and thus incontinence is added to the retention. In the milder forms of the malady, the power of contraction is only diminished, not entirely lost, and a portion of the urine is still voided, under the influence of the will, either at regular or remote intervals. The duration of the paralysis varies from a few hours or days to several weeks, months, or even years. Occasionally it ceases only with life.

Morbid Alterations.—It is unnecessary to give a detailed account of the changes observed in this disease after death. As in other vesical affections, signs of congestion or of inflammation are generally discovered in various parts of the lining membrane; the muscular fibres are pale and indistinct, and the parietes of the organ are remarkably thin, flabby, and attenuated. In some instances, blackish, dark-colored, or grayish spots are visible, and are evidently the effect of incipient gangrene. In neglected cases, or in those which run their course very rapidly, the different coats are very much softened, and hence they sometimes give way at one or more points, followed by an escape of the urine into the general peritoneal cavity. When the paralysis is of long standing, it is not unusual to meet with ulcers and phosphatic incrustations of the mucous membrane. Disease of the associated organs is by no means uncommon, but does not form a necessary concomitant or consequence.

Prognosis.—The prognosis of vesical paralysis can be correctly estimated only by an attentive consideration of its causes. Much will also necessarily depend upon the treatment, the age of the patient, the state of the system, and the duration of the disease. When the retention of urine, which constitutes, as has been already stated, the characteristic symptom of the affection, is not early relieved, a long time must necessarily elapse before the elongated and overstretched fibres will regain their former vigor. When the distension continues in full force for four or five days, the tone of the organ is liable to be destroyed for life; indeed, such cases often speedily terminate in death, even when the most urgent symptom has been relieved by the catheter. An instance in point occurred to me in 1845, in an

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found this practice particularly useful in cases of paralysis, attended with pain and spasm of the neck of the bladder, and a frequent desire to urinate. When the accumulation is very great, and has continued for several days, it is a good rule not to evacuate all the water at once, for fear of inducing severe depression from the sudden removal of the stimulus of distension. I have seen several cases in which I am satisfied the patients lost their lives from inattention to this precaution. My own practice, under such circumstances, is not only to allow a small quantity of urine to remain, but to support the weakened organ by swathing the abdomen, precisely as after parturition, and tapping in ascites. When the catheter is permanently left in the bladder, it should be confined in the usual manner, and cleaned every other day; otherwise it will be certain to become incrustated with inspissated mucus, if not with earthy matter, and thus produce an injurious impression upon the affected organ.

Much harm is often done in this disease by the protracted employment of the catheter. The proper plan is always to discontinue it as soon as it is discovered that the organ has regained its expulsive power. The patient should be requested from time to time to try to evacuate the bladder by his own efforts, and if he is not able to effect the object completely, he should be assisted with the catheter; for the rule is, in all cases, to draw off every particle of water at least twice in the twenty-four hours. By employing the instrument too long, the organ becomes habituated to its use, and a much longer time will necessarily elapse before a cure takes place.

The second indication, which is to impart tone to the bladder, or reanimate its exhausted energies, may be fulfilled in various ways. It has been already seen that the regular evacuation of the urine is sometimes of itself sufficient to answer this purpose; in general, however, it has to be aided by other means, both of a constitutional and a local character, and it is not always easy to determine which of these is entitled to the greater share of the credit.

Among the remedies which ought to be mentioned first are *cathartics*, which constitute a most valuable class of agents in nearly all cases of this disease, no matter what may be its exciting cause. Of the truth of this statement no one can entertain a reasonable doubt if he reflects, for a single moment, that paralysis of the bladder is frequently associated with paraplegia and excessive torpor of the bowels. A brisk cathartic, consisting of calomel and jalap, or calomel, rhubarb, and aloes, will, under such circumstances, often pro-

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become irritable, they are to be regarded as an evidence that they have been carried far enough, that the dose should be modified, or that the offending substance should be temporarily suspended; to be resumed, if necessary, at another period. Instead of the strychnine, the extract of *nux vomica* may sometimes be advantageously used; it occasionally agrees better with the system, and seems to exert a more happy influence in arousing the enfeebled organ to the performance of its functions.

In paralysis of the bladder, consequent upon typhoid and other fevers, masturbation, and general exhaustion, few remedies are so serviceable as the *arnica*. It is a powerful stimulant, and acts with peculiar energy upon the nervous system. It is, therefore, well adapted to all cases of the malady dependent upon general debility. It may be administered in substance, infusion, extract, or tincture. I usually prefer the latter, as more elegant and agreeable, in doses of from forty to sixty drops three times a day. Its effects should be carefully watched; otherwise it may cause vomiting and purging, headache, vertigo, and spasmodic twitchings. Where a tonic is at the same time indicated, it may be usefully combined with some of the vegetable bitters, acids, or ferruginous preparations.

Strong testimony has recently been published in favor of the *ergot of rye* in the treatment of this affection. The attention of the profession was first directed to the remedy by Dr. Allier, in the *Journal des Connaissances Médico-Chirurgicales*, for November, 1838, in consequence of having witnessed its stimulating effects upon the urinary organs in females to whom it had been administered to promote uterine contractions. He relates four cases of the disease, which were apparently cured by it, although in one it had existed nearly three months before its employment. They all occurred in elderly men, from over-distension of the bladder. The dose usually given, in the twenty-four hours, was from one to two scruples of the recent powder.

Since the publication of the paper of Dr. Allier, other cases in which the *secale cornutum* was successfully employed have been reported by various writers, and the remedy may therefore be regarded as one of no ordinary promise. Dr. Day, of London, in his interesting *Treatise on the Diseases of Advanced Age*, republished at Philadelphia, declares that he has often used the *ergot of rye* with the best results in the paralysis of the bladder of old people, and he gives it a decided preference over *cantharides* and *arnica*. He usually administers it in the form of a very strong tincture, pre-

pared with six ounces of the substance to a pint of spirit; the dose being a drachm three times a day in an effervescing draught of citrate of ammonia. In whatever form the article be used, it is generally best to begin with eight or ten grains every five or six hours, and to increase the dose gradually as the treatment progresses. It should never be pulverized, when given in substance, until it is about to be used, as exposure has a tendency rapidly to deteriorate it, and render it inert. My experience with the ergot is limited; I have employed it in a few instances, but without realizing any special benefit.

The ergot commonly excites an abundant secretion of urine, slight tenesmus of the bladder, and pain, or a sense of uneasiness, in the hypogastric region. When given in large doses, or for any length of time, it is liable to produce stupor, general heaviness, dilatation of the pupils, slight convulsive tremors, and a sense of pricking, or formication. In enfeebled states of the system, it sometimes manifests a septic tendency, which is best counteracted by a nourishing animal diet.

In the *inflammatory* form of the disease, characterized by pain and spasm of the neck of the bladder, with a constant desire to urinate, and more or less febrile commotion, the treatment should be conducted strictly upon antiphlogistic principles. Blood is taken from the arm, or from the neighborhood of the affected part by leeching or cupping; the bowels are properly evacuated; and recourse is had to the warm bath, hot fomentations, and anodyne enemata. The distended and enfeebled organ is relieved by the catheter, which is continued until the urgent symptoms have disappeared, when the emission of the urine is intrusted as much as possible to the efforts nature.

When the disease is associated with *general debility*, tonics are indicated, and often exert an excellent effect, both upon the system at large, and upon the urinary bladder. Much judgment is frequently necessary to enable us to determine the proper period of their employment, the time of their continuance, and the article that is best adapted to the particular case in hand. In general, a preference is conceded to the chalybeate preparations, of which the best are the muriated tincture, the sulphate and the citrate, in the form of the aromatic wine. The first of these is supposed to have a specific tendency to the urinary organs, and may be administered, in a small quantity of mucilage, three times a day, in doses of from ten to twenty drops. The sulphate is usually advantageously com-

bined with quinine, or some of the vegetable extracts; the common dose is about two grains. The aromatic wine, which is one of the best preparations of the kind we possess, usually agrees better with the stomach than either of the two others, and is particularly adapted to vesical paralysis associated with anæmia, a pale tongue, a pallid complexion, and cold extremities. The dose is from one to two drachms thrice a day. It need hardly be remarked that any tonic that may be selected may be combined, if it be thought necessary, with strychnine, cantharides, arnica, and other articles.

In *hysterical paralysis*, the mind is affected rather than the bladder. The muscular fibres of this organ retain their contractility, but the patient is unable, or pretends to be unable, to excite them to action. The want of power is no doubt sometimes real, but oftener it is feigned. Such cases are always promptly relieved by *assaftida*, *valerian* and *morphia*, aided by the catheter, which is frequently obliged to be used three or four times a day; these remedies, however, are merely palliative, not radical; and, with regard to the instrument, it may be remarked that the patient usually gets worse the oftener it is employed. To effect a permanent cure, the treatment should be directed to the improvement rather of the mind and of the general health than of the condition of the bladder. As this subject, however, will be brought up again for consideration, it may be dismissed, for the present, with the remark, that there is no disease more difficult of management, none which requires nicer judgment for its detection, and none which is so annoying to the practitioner.

Counter-irritation is a useful auxiliary after the bowels have been evacuated and the secretions corrected, and may be excited by the application of a blister, tartar-emetic ointment, the moxa, or the actual cautery.

A succession of *blisters* over the dorso-lumbar region often proves highly beneficial, by stimulating the spinal cord, and the nerves which it sends to the lower half of the body. The vesicating agent should be retained long enough to elevate the epidermis, and to cause considerable excitement in the surrounding parts. The best dressing is an emollient poultice, renewed every six or eight hours for a day and a half, when the dead cuticle should be removed over a space about the size of an American dollar, and the raw surface sprinkled with the fourth of a grain of strychnine. The application may be repeated every twelve hours, either in the same, in smaller, or in larger quantity, according to the impression which it

makes upon the system. The remedy, thus used, is sometimes much more striking in its effects than when it is exhibited internally. It deserves to be noticed, with respect to this powerful article, that if the vesicated surface is covered with lymph, it will produce little or no impression. It should, therefore, be carefully inspected at each dressing, and divested of adherent matter. Where this cannot be done without inflicting unnecessary pain, the quantity of the strychnine should be proportionably increased. As soon as the vesicated surface begins to heal, another blister is to be applied, either at the same point, or in its immediate vicinity.

There is hardly any form of vesical paralysis, excepting, perhaps, the inflammatory, in which this mode of counter-irritation will not prove more or less advantageous. In the milder varieties, it sometimes acts like a charm. I recently had under my charge a gentleman from Bowling Green, fifty-nine years of age, a blacksmith by trade, who was relieved in this way in a few days. He had slight weakness of the bladder for a number of years, and also of the lower extremities, especially the left. His general health had not been good, he was dyspeptic, heard badly, and was constantly annoyed with dizziness. He had voided his urine with considerable difficulty for fifteen months, and for the last three weeks he had not been able to pass a drop without the aid of the catheter. I purged well with calomel, colocynth, and jalap, gave him, three times a day, a pill composed of quinine, sulphate of iron, extract of quassia, and strychnine, regulated his diet, had his spine thoroughly rubbed morning and evening with strong veratria ointment, and applied a pitch plaster with cantharides, to the lumbar region. Under this treatment, he so far recovered, in a few days, as to be able to lay aside his catheter; his general health is much improved, and the vesical paralysis has entirely disappeared.

I am not partial to *pustulation* with tartar-emetic ointment, but this mode of counter-irritation is occasionally advantageous, and may be employed either upon the sacrum, the loins, the hypogastrium, or the perineum. The strength of the ointment may be increased by the addition of croton oil, but its effects require to be carefully watched, otherwise the patient may experience all the unpleasant consequences of an overdose by the mouth. The remedy should be seldom used.

With the *moxa* I have no experience in the treatment of this affection. It may possibly occasionally answer in mild cases, but I should hardly be disposed to temporize with such an inefficient

agent in the more severe grades of the complaint. Larrey speaks of it in high terms in this and other analogous diseases, but I am unacquainted with any writer in this country or in Great Britain who advocates it. The best points for its application are the upper part of the sacrum, the perineum, and the supra-pubic region.

The *actual cautery* is a much more energetic agent than the moxa, and, in the more rebellious forms of vesical paralysis, is not only a justifiable, but a highly proper remedy. The best place for applying it is about the junction of the last lumbar vertebra with the sacrum; in traumatic cases, however, when the disease depends upon injury of the spine, it ought, sometimes, to be used much higher up. The great advantage of the hot iron is that it establishes not only an excellent issue, furnishing for weeks and even months an abundant secretion of pus, but that it makes a much stronger and more abiding impression upon the nervous system. The eschar usually separates in six or eight days, leaving a fine, raw surface, which may afterwards be used, if deemed proper, as an avenue for the introduction of strychnine and other kindred articles. The cautery which I commonly employ for this object is fully one inch in diameter. By putting the patient under the influence of chloroform, the application may be made without the slightest pain. This mode of counter-irritation is particularly valuable in vesical paralysis associated with paraplegia, or loss of power in the lower half of the body, whether the result of traumatic injury, over-tension, or senile decay.

Counter-irritation by *seton* is hardly to be recommended in any case. It is a dirty, filthy, painful method, which can scarcely be too pointedly condemned. If it be at all justifiable, under any circumstances, it is where the palsy is associated with an irritable condition of the neck of the bladder, along with a frequent desire to urinate. In such a case, a seton, worn in the perineum, might, I conceive, be advantageous, and, perhaps, even preferable to some of the other forms of counter-irritation, already described.

Frictions over the perineum and hypogastrium with stimulating *embrocations*, such as turpentine and ammonia, are sometimes serviceable. In several instances, I have derived material benefit from the use of mustard plasters to these parts and to the sacro-lumbar region. They should be applied at least once a day, and be retained for twenty-five or thirty minutes at a time, or until the surface of the skin is completely reddened. An irritating plaster, worn upon the loins or the sacrum, is occasionally attended with the happiest

every known method of treatment, both general and local, for ten weeks, a cure was speedily effected by injections of strychnine. The patient was a man aged sixty-eight, who, after a drinking bout and exposure to cold, found himself unable to void his urine. At the end of the above period, Dr. Lecluyse dissolved six grains of strychnine, with a little alcohol, in a pint of water, and of this solution he injected into the bladder, previously emptied, two ounces four times a day. No effect was perceptible until about the end of the fifth day, when some urine appeared between the catheter, which had been retained in the bladder, and the urethra. The instrument being removed, the patient found that he had regained complete voluntary command over the bladder; and from this time on he experienced no further inconvenience.¹

The direct application to the surface of the bladder of the tincture of cantharides was proposed some years ago by Mons. Lisfranc², of Paris. One drop of the fluid was introduced through a catheter, and followed by an injection of simple lukewarm water. Next day double that quantity was instilled, and the operation was afterwards repeated night and morning; an additional drop of the tincture being used on each successive occasion. No perceptible local irritation ensued, and a cure was soon effected; all the ordinary methods of treatment having previously failed. It is hardly possible, on the one hand, to conceive that such feeble medication would do much good, and, on the other, not to conclude that, in the case before us, the patient would not have recovered without it just as promptly as with it.

¹ *Annales de la Société d'Emulation de la Flandre Occidentale*, 1850.

² *Amer. Journ. Med. Sciences*, New Series, No. 12, p. 478.

CHAPTER VI.

HETEROLOGOUS FORMATIONS OF THE
BLADDER.

SECTION I.

SCIRRHUS OF THE BLADDER.

SCIRRHUS of the bladder, properly so called, is of such infrequent occurrence that many pathologists have been induced to deny its existence. Mr. Travers, in a valuable paper on malignant diseases, in the seventeenth volume of the *Medico-Chirurgical Transactions of London*, remarks that he has never met with true scirrho-cancerous ulceration of this viscus. Mr. Howship, Sir Benjamin C. Brodie, and Mr. Coulson, in their works on the urinary organs, hardly allude to the subject; Mr. Mayo, in his *Outlines of Pathology*, is equally silent; and so is Mons. Begin, the author of an elaborate article on cancer, in the *Dictionnaire de Médecine et Chirurgie Pratiques*. Similar testimony is borne by Dr. Walshe, in his excellent and learned paper upon this subject in the *Cyclopædia of Practical Surgery*, published under the supervision of Dr. Costello, of London. From all this, it may be inferred that the disease in question is exceedingly rare. I have myself witnessed only one case of it in a practice of twenty-five years. Dr. G. L. Bayle, of Paris, in his *Treatise on Cancerous Maladies*, speaks, it is true, of this affection at considerable length, describing its symptoms, diagnostic characters, causes, and pathological effects; but, as he has given no cases of it, we are left in doubt as to whether it is really scirrhous or some other disease. That the lesion is occasionally propagated to this organ from the neighboring structures, as the rectum and prostate gland in the male, and the uterus and vagina in the female, is familiar to every physician. My own practice has furnished me with a number of instances of it in both sexes.

The disease, which has been observed more frequently in men than in women, is most common between the ages of forty-five and sixty, agreeing, in this respect, with scirrhous as it occurs in other

organs and tissues of the body. The parts of the viscus most liable to it are the neck and bas-fond; it is seldom seen at the summit or body. The extent of the morbid deposit may be very slight, or so great as to involve nearly the whole of the organ. In a case which I shall describe fully at the close of this chapter, the disease formed a broad thick belt round the entire circumference of the bladder, from its neck as far as the openings of the ureters. In an instance mentioned by Lallemand, the tumor was two inches thick, and from two to three inches in diameter; it commenced just behind the prostate gland, and was of a dense, gristly consistence. All the tunics of the bladder were transformed into a lardaceous, scirrhus substance.

Scirrhus of the bladder occasionally *coexists* with scirrhus in other organs. The parts most liable to suffer in this way are the liver, the uterus, the breast, and the prostate gland. Professor Samuel Cooper, of London, has described a well-marked example of scirrhus tumor of this organ, in a subject whose thigh bone of one side and a rib were infiltrated with the same morbid matter. Occasionally, the disease coexists with stone, or polypous growths.

Of the *causes* of this disease, as it occurs in the bladder, we are totally ignorant. Its mode of invasion is generally insidious; its progress slow; its termination fatal. No plan of treatment, of which we have any knowledge, exerts the slightest influence over it, beyond that of a palliative.

The bladder, on *dissection*, is generally found to be contracted, and to contain a small quantity of dark-colored, fetid urine, mixed with pus, lymph, or sanguinolent matter. Its coats are hypertrophied, or irregularly thickened, and so firm and dense as to grate under the knife. The muscular fibres are unnaturally red and distinct, and sometimes they exhibit the peculiar fasciculated arrangement so conspicuous in chronic inflammation or vesical catarrh. The outer surface is occasionally covered with lymph, or adherent to the surrounding parts; and cases occur in which the viscus communicates with the ileum, the rectum, vagina, or uterus. Laid open, so as to exhibit its interior, the inner surface is found to be studded with scirrhus tubercles, closely aggregated together, firm and dense in their texture, and of a white, grayish, or lardaceous appearance. Occasionally, there is only a single mass, which is then, perhaps, of considerable volume, and of unequal density, structure, and color. In cases of long standing, the morbid deposit is usually in a state of advanced ulceration, and presents a foul, ragged surface, with

the surface and elevated edges. In some instances, again, the surface is studded with small excrescences, like the top of a cauliflower. The cellular tissue is generally the nidus of the heterologous matter. The lining membrane immediately around the disease is somewhat thickened, preternaturally dense, injected, and sometimes ulcerated.

During the progress of this disease, the associated organs are apt to become implicated. When the scirrhus is situated at the neck of the bladder, it may extend to the prostate gland, and completely obstruct its orifice. In its progress backwards, it sometimes encroaches upon the coats of the ureters, and thus prevents the passage of the urine. The kidneys are usually more or less affected, and the secretions are to be variously altered, being either dilated or contracted, and lined with lymph.

Persons affected with scirrhus of the bladder are troubled with a constant discharge of watery urine, which generally passes off in a small quantity several times by drop: with a sense of scalding or burning at the neck of the organ and along the course of the ureters, with frequent straining: and with deep-seated pain in the rectum, perineum, anus, thighs, and lower limbs and extremities. The pain is either of a dull, aching, or stinging character, or it is sharp and lancinating, shooting in various directions, and keeping steady pace with the progress of the disease. The general health, at first unimpaired, gradually declines: the countenance assumes a peculiar sallow appearance; the appetite fails: the secretions become deranged; the bowels are constipated, and the patient is finally, after months of suffering, worn out by hectic irritation. In the only case of this disease that has fallen under my notice, I witnessed, during a period of several months, an amount of suffering such as I never saw before, and hope I may never be called upon to behold again.

There are no signs by which scirrhus can be distinguished from other diseases of the bladder. The most reliable evidences are, the peculiar character of the pain, the progressive emaciation, the wan and sallow state of the countenance, the age of the patient, the excessive burning at the neck of the organ and in the urethra immediately after micturition, and the occasional discharge of small fragments of the heterologous matter. Negative testimony is afforded by the operation of sounding. No positive conclusions can be drawn from the frequent micturition, the condition of the urine, and the presence of mucus, pus, or puriform fluid.

The following case, already more than once alluded to, strikingly illustrates the symptoms, pathological appearances, and hopeless character of this disease, as well as the futile nature of any mode of treatment that may be instituted for its relief.

The patient, Mr. G., a married gentleman, was forty-four years of age, and a lawyer by profession. He was a man of sanguine temperament, very active in his habits, stout, well-built, and generally in good health. When twenty years old, he contracted gonorrhoea, which terminated in stricture of the urethra, which lasted until within a short period of his death, and which was greatly aggravated by a new attack of urethritis in the winter of 1841. The narrowing extended from within about three inches of the meatus down to the bulb, and was often accompanied, especially of late years, by a thick and rather profuse discharge, not unlike that of the affection just mentioned. Micturition was difficult, as well as painful, and had to be often assisted by compression and pulling of the penis. Latterly, the urine was voided in a small, feeble stream, and much force was required to expel the last drops. For the last two years and a half, the water was occasionally passed involuntarily, on which account the patient was constantly obliged to wear a cloth in his pantaloons, and not unfrequently to change the pantaloons themselves once or twice a day, in order to keep himself clean and comfortable.

About seven years and a half ago, soon after the second attack of urethritis, he began to experience pain in the region of the bladder, accompanied with frequent micturition, and great uneasiness at the head of the penis. The urine, which was rather above the natural quantity, contained an unusual amount of mucus, and emitted a strong ammoniacal odor. Occasional attacks of acute cystitis supervened, but they were generally slight, and always promptly yielded to the copaiba mixture. During all this time the general health was excellent; the complexion was fine; and the patient was quite fleshy. It may be remarked here that his habits were strictly temperate, and that he led a most active and exciting life, especially during the presidential campaigns of 1840 and '44. In this condition he continued until February, 1848, when, after prolonged exposure to the night air, great bodily fatigue, and the excessive excitement consequent upon the gubernatorial nomination at Frankfort, on the 22d of that month, he was seized with retention of urine. Dr. Sneed, an eminent practitioner of that city, being sent for, attempted to afford relief with the catheter, aided by venesection

SYMPTOMS AND COURSE OF THE DISEASE.

After great difficulty, the instrument was passed, and Air G. described to me his sufferings, which he has since seen of the most intense and agonizing nature. He has been partially relieved, he arrived at his residence in the city on the 26th, and I was immediately requested to see him. His symptoms at this time were those of acute cystitis. He was compelled to urinate every thirty or forty minutes, and he suffered from deep in the pelvis, running along the ureter, and from uneasiness in the head of the penis which he constantly compressed with his hand. The pain was of a hot, burning character, and was always more severe for a few minutes after micturition. The urine was highly offensive, of an ammoniacal character, and was white, opaque, and thick after having been some time standing. He was altered firmly to a diet of gruel and water. He voided in different positions, lumps of mucus, and sometimes small pieces of the mucous membrane. Some of these were as long as an inch long, and were of a yellowish color, and were decayed and softened. He was also very much distressed in passing them, and he was obliged to stop several times to allow their expulsion. He was also very much distressed by the rigid abstemiousness of his diet, and he was obliged to use suppositories, and he was also very much distressed by the internal inflammation of the bladder, and he was restored to his former state of health in three weeks. The symptoms of the disease were not relieved, and he had to be treated with great care.

On the 1st of March, the patient was again seen, and he was found to be much improved in his case; his appetite was good, and he was able to attend to his business. The micturition was now generally from the bladder, and the urine excreted was now of a normal character, and he was free from the attack from which he had been suffering. He was now one of the state electors, and he was going to the convention for nomination to the legislature, and while there, as well as on his return, he suffered severely with his bladder and urethra. He was now in the city, and he immediately took to his bed. The symptoms were now those of acute cystitis, that is, a severe inflammation of the bladder. The urethra was exquisitely

irritable in the greater part of its course; there was excessive pain in the head of the penis during and immediately after micturition, which was performed from twenty-five to forty times in the twenty-four hours; and the urine, of a fetid, ammoniacal odor, deposited, upon standing, a large quantity of thick, ropy mucus, often streaked or intermixed with pus. There was considerable tenderness on pressure of the perineum and the supra-pubic region, especially the latter, where it was usually followed by a desire to pass water, and by severe distress in the head of the penis. Whenever the patient attempted to empty his bladder, he was obliged to turn over on his right side, every effort to accomplish his object in any other posture proving abortive. The liver was habitually torpid, and, in consequence of the anodynes necessary to relieve his suffering, the bowels were seldom moved without the aid of purgatives. Notwithstanding this, the skin was soft, the pulse natural, and the appetite good. Under a course of treatment essentially similar to that pursued in March, the symptoms were somewhat ameliorated. In a few days, however, he became worse, and my colleague, Professor Miller, joined me in consultation. It was agreed that we should inject the bladder with a solution of nitrate of silver in the proportion of two grains to the ounce of water, and to continue the use of the copaiba mixture, with laudanum and Hoffmann's anodyne, to allay the violent spasm during and immediately after micturition. Such was the exquisite sensibility of the urethra that I was obliged, before introducing the catheter, to put the patient under the full influence of chloroform. The instrument, a middle-sized one, passed without difficulty, and the injection was followed by but little pain. It was repeated in four days, but it caused so much distress that we were induced to abandon it, and substitute, successively, a weak solution of sulphate of copper, nitric acid, and creasote, and, finally, an infusion of poppy-heads, opium, and extract of cicuta. These preparations were used, respectively, once a day, every other day, or every fourth day, according to circumstances, in the quantity of from two to three ounces, and retained, according to the tolerance of the bladder, from fifteen minutes to an hour at a time. No marked improvement followed their use. On one or two occasions the patient seemed to be better for a few days, but then, all at once, and without any assignable cause, the symptoms recurred, if possible, with increased violence. The copaiba, on the whole, seemed to afford more relief than any other single article, or, in fact, than all other remedies put together. It was taken, at first, alone, and afterwards,

as it lost its effect, in combination successively with benzoic acid, the muriated tincture of iron, soda, potash, nitric acid, in short, everything that could be thought of; and all without any very obvious advantage. The warm bath, used for an hour at a time, seemed for a while to exert a composing influence, but it was soon obliged to be discontinued on account of the fatigue and inconvenience attending its administration.

Early in September, Dr. Samuel B. Richardson was added to the consultation. The patient, at this time, was considerably emaciated, and had little or no appetite; the tongue and mucous membrane of the mouth had a red, fiery appearance; the liver and bowels were torpid; there was a sense of excessive heat in the anus and rectum; much difficulty was experienced in retaining the injections; and the urine, which was decidedly alkaline, was voided, on an average, every hour and ten minutes. From two to five minutes were required to complete the act, which was always accompanied with excessive pain, violent straining, severe spasm of the muscles of the thighs and buttocks, and a feeling at the head of the penis and anterior part of the urethra, as if molten lead had been poured upon them. There was also, at this period, severe pain in the sacro-lumbar region, which, however, was promptly relieved by the application of a gum ammoniac and mercurial plaster. It is worthy of remark that there was, at no time, during the whole attack, any fever beyond a day or two, and then it was always very slight. The pulse was generally about seventy in a minute, soft, and regular.

During the last few weeks, the emaciation, which had been all along progressive, became very great, and at the time of his death it was extreme. The stomach was occasionally irritable, but rather as an effect of the medicines than of the disease; and the sleep was, of course, greatly disturbed by the constant inclination to void the urine. The mind remained unimpaired up to the last week, when, for the first time, it began to wander. Finally, the urine became very scanty and highly alkaline, and such was the excessive pain attending its passage, that the patient was obliged, for the last five days of his existence, to be kept pretty constantly under the influence of chloroform. This, however, had the effect of only partially relieving his suffering. He expired at 8 o'clock A. M., on Wednesday, September 27, 1843.

The body was examined eight hours after death, in the presence of Professor Miller, Dr. Richardson, Dr. Proctor, and Dr. Bozeman. The bladder, separated from the surrounding parts, was unusually

large and firm. In detaching it at its neck, I accidentally ruptured its anterior wall, and let out a small quantity of thick, whitish, and offensive mucus. Laid open longitudinally in front, the interior was found to be in a scirrhus condition, from the cervix to the insertion of the ureters, in the entire circumference of the organ. The heteroclite matter was of a whitish color, dense and firm, and, at one point, nearly an inch in thickness. At its upper boundary it formed a sort of belt, which was so closely contracted as hardly to admit the end of the middle finger, and which thus served to divide the cavity of the reservoir into two compartments. Of these, the lower was quite rough on the surface, slightly ulcerated at two points, and studded with vegetations, or shreds of lymph and mucous membrane. The muscular and internal tunics were in a state of complete disorganization. The upper portion of the reservoir was comparatively healthy, and alone capable of retaining any urine during life. It presented at its inferior and posterior part the orifices of the ureters. The mucous membrane was of a dark slate-color, and studded with small reddish granulations. The muscular coat was somewhat thickened, but perfectly free from scirrhus; the peritoneal investment was healthy.

The prostate was not enlarged, but had evidently participated in the scirrhus degeneration. It was of a whitish color, unaltered in shape, and of preternatural density. The urethra was not examined.

Both kidneys were affected with Bright's disease. They were considerably smaller than natural, of a pale reddish complexion, and somewhat wrinkled or fissured; their cortical substance contained a considerable number of yellowish granulations, from the size of a pin-head to that of a millet-seed, and of a dense, firm consistence. The mucous membrane of the pelves and calyces was inflamed, and the fibrous tunic, though free from disease, was easily peeled off in its entire extent. The right kidney presented, at its upper extremity, a serous cyst, as large as a walnut without its shell. The supra-renal capsules were healthy. Both ureters, especially the left, were somewhat dilated near their entrance into the bladder, and their lining membrane was inflamed throughout.

The seminal vesicles were of a light brownish tint, and in a state of complete atrophy; the right being situated nearly horizontally. The deferential ducts were pervious, and contained each a drop of thin, dirty, reddish fluid. It may be added here, as an interesting physiological circumstance, that the patient had expe-

rienced no sexual desires for nearly six years, though both testes had all along been perfectly sound.

The stomach, bowels, peritoneum, and spleen, were perfectly healthy. The liver, which was about the ordinary volume, was in a state of cirrhosis throughout. The gall-bladder contained about half an ounce of moderately thick, black bile.

In the subjoined case, for the particulars of which I am indebted to Dr. W. H. Church, resident surgeon of the New York Hospital, the disease was associated with carcinoma of the liver. The patient, Robert Shippen, a mulatto, and a servant by occupation, forty years of age, was admitted into the above institution on the 2d of January, 1851, under Dr. Watson, the attending surgeon, to whose kindness I am indebted for an opportunity of inspecting the urinary apparatus after death.

His first sickness occurred twenty years ago, when he contracted gonorrhoea, which was treated with injections, and immediately after the cure of which the stream of water became smaller than natural, and so continued to the present time. Independently of the above trouble, he was never seriously ill until a year ago, when he had intermittent fever, which lasted four weeks. Two months after this, he began to feel severe darting pains in the regions of the liver and spleen, aggravated during defecation, which was effected with a good deal of difficulty, and attended with much straining. Very soon his urine became dark-colored, and in voiding it he felt a burning pain through the whole extent of the urethra; frequently during its passage the water was suddenly stopped for a moment, when it escaped drop by drop for several minutes. These symptoms continued to increase in severity until six weeks ago, when, in attempting to relieve his bowels, he found it almost impossible to do so; a discharge of fetid purulent matter being often the only result of such efforts. There were also at various times discharges of a similar character from the urethra.

About a month before his admission, he noticed, for the first time, a swelling and hardness at the upper part of the abdomen, which have gradually increased to the present period, causing difficulty of breathing and a feeling of weight in that region. Two weeks ago his legs and feet began to swell, and he states that he has also sometimes noticed slight cedema of his face.

At the time of his admission, the patient was unable to lie upon his left side or back without pain, and he was obliged to pass his urine, which was dark and bloody, very frequently, both day and

night. The stream was very small and twisted; sometimes, indeed, double. Micturition was always attended with a simultaneous passage from his bowels. The patient referred his greatest distress to the perineum; and upon examining this part, a tumor was found projecting from, and filling the space between the urethra and the rectum. An attempt was made to pass a bougie into the bladder, but it was arrested at the bulbous portion of the urethra; the finger was then introduced into the rectum, but the instrument could not be felt, owing to a large firm tumor occupying the place of the prostate gland, and extending further back than the finger could reach; it was tender on pressure, and unyielding. The attempt to pass the bougie caused so much hemorrhage that it was immediately desisted from. When sitting up, a tumor was perceived in the hypogastrium, which, on handling, had the feel and fluctuation of water; but partially disappeared on the resumption of the recumbent position. He complained of continual pain in the abdomen, particularly in the liver, which filled the right hypochondriac and epigastric regions, extending far over towards the left side, as well as several inches below the umbilicus. The organ was not tender on pressure. The quantity of urine was less than natural, and, on being tested, was found to be alkaline, with slight traces of albumen, but no other evidence of derangement. His legs and feet were somewhat cedematous. The pulse was weaker than natural and more frequent; he had but little appetite; the tongue was covered with a brown fur, and he complained of great thirst; the bowels were constipated. He was ordered ten grains of calomel, to be followed by rhubarb and magnesia, to drink freely of flaxseed tea, and at bedtime to take one drachm of tincture of hyoscyamus.

January 3. The medicine has operated freely; the patient slept better than usual, and felt more comfortable this morning. He can void his urine in small quantities without a simultaneous discharge from the rectum, and the secretion is slightly increased. He was directed to take, three times daily, a pill composed of three grains each of blue mass and extract of taraxacum, with the free use of demulcent drinks, and a nourishing diet.

January 12. There is not much change since the last report. The patient complains of severe pain in the abdomen, and his pulse is more feeble. The former treatment was continued, with a bottle of porter daily, and anodynes, to relieve the pain. This morning he had a severe attack of epistaxis, which ceased spontaneously.

January 14. The patient has continued gradually to sink, and

this morning the pulse is hardly perceptible at the wrist. The surface is cold, and he has severe pain in the abdomen. He lingered until twelve o'clock at noon, when he died.

The body was examined twenty-four hours after death. Upon cutting into the cavity of the abdomen, an effusion of serum was found amounting to one gallon. The liver was enormously enlarged and filled with cancerous deposits, which were distributed through the whole of its substance. On the surface they appeared in round patches, slightly elevated and varying in size from that of a sixpence to that of a dollar. A section of one of these tubercles exhibited the characteristic aspect of soft cancer. The organ weighed, immediately after its removal, eleven pounds and a quarter. The intestines were healthy. The whole urinary apparatus was removed and carefully examined. The kidneys were somewhat enlarged, as were also their pelves; and the caliber of the right ureter was increased to at least three times its normal size.

Between the bladder and the rectum was a large scirrhus tumour, the size of a goose's egg, involving the inferior wall of the bladder and separating it from the bowel.

The urethra was easily traced as far as the bulbous portion, but here it was almost obliterated, and could not be distinctly followed into the bladder. The prostate gland was about the natural size, but unusually firm, and exhibited well-marked appearances of scirrhus disease in the upper portion of its extent. The posterior wall of the bladder was covered with bright red granulations, very much resembling the papillæ of the tongue in scarlatina, and occupying the place of the mucous membrane upon the anterior face of the tumor. Similar granulations also existed in the urethra for two-fifths of its length, but they were of a darker color and firmer consistence. The tumor in its whole extent presented the scirrhus character. The cavity of the bladder was diminished in size. The rectum was slightly congested, but in other respects healthy.

A hard tumor, of the size of a Madeira nut, was firmly attached to the internal femoral vein. It was probably an enlarged lymphatic ganglion. All the other organs of the body were in a healthy condition. A few atheromatous deposits were found in the commencement of the aorta. The nares were examined, but nothing could be discovered there to account for the epistaxis.

SECTION II.

ENCEPHALOID.

The bladder is sometimes the seat of encephaloid. This disease, which is likewise known by the name of fungus hæmatodes, soft cancer, or medullary sarcoma, is of a malignant character, and usually runs its course with great rapidity, destroying life occasionally in a few months. Any portion of the bladder may be affected with it, but its most common situation, by far, is just behind the neck of the organ, between the mouth of the urethra and the outlets of the ureters.

The tumors vary much in number and appearance. Sometimes there is only a single one, which projects into the bladder and almost obliterates its cavity. In other instances as many, perhaps, as six, ten, or a dozen, are found, from the volume of a pea up to that of a walnut. In their shape no uniformity is observable. Nevertheless, they are, for the most part, somewhat rounded or pyriform, their attachment being effected by a narrow, elongated pedicle. The larger tumors often grow from a broad, flattened base, and occasionally from two or even three distinct footstalks. Externally they are of a grayish, or marbled appearance, while in their interior they are of a dull white, drab, ash-color. Their consistence is also variable, though in most instances it may be said to bear a very close resemblance to the cerebral substance of a child under two years of age. Occasionally they exhibit a compound structure, one part being encephaloid, another melanotic, a third hematoid or scirrhus. Sir Benjamin C. Brodie supposes that these tumors have their origin in the mucous membrane, an opinion which, I am convinced, is erroneous. From repeated examinations, I can unhesitatingly affirm that they take their rise in the submucous cellular substance, from which they project into the cavity of the bladder, carrying the lining membrane of that viscus along with them, so as to receive from it a complete investment.

Tumors of this kind are often associated with calculous concretions, which are either partially imbedded in their substance, or else they lie loose in the bladder. When the patient labors, as he is apt to do, under the calculous diathesis, the surface of the morbid growth may become incrustated with sabulous matter, and hence, when the sound is employed, the sensation, and even the

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It may be of such a character as to deceive the most experienced surgeon.

When of large size, these tumors encroach so much upon the bladder as to fill in great measure, its cavity. Under such circumstances it often occurs that the coats of the organ are destroyed by extensive absorption, and that the morbid growths project through the perforation which is thus formed into the surrounding parts as the colon, rectum, or small bowel. Again, it may happen that the disease, commencing in the vagina or uterus, may affect the bladder secondarily. In a patient who died in the Mid-Durham Hospital with medullary sarcoma of the organs just mentioned, Mr. Mayo¹ found the bladder studded with small, white nodules about the size of peas, which had formed behind the mucous coat and projected inwards. They appeared in all three of these structures of the same medullary texture.

In some cases of encephaloid, the intermediate substance of the bladder is perfectly healthy: in others it is diseased, and hypertrophy is its most common alteration. Sometimes the organ is very much enlarged, and occasionally, though rarely, it is greatly enlarged. The enlargement has been known to amount to upward of five-sixths of the natural volume, the viscus being unable to hold more than an ounce or two of fluid at a time. In cases of long standing, attended with great difficulty of passing water, the muscular coat becomes immensely thickened, and of a deep reddish color. The ureters are also sometimes affected, most commonly dilated, from the morbid growth plugging up their orifices, and thus causing the urine to accumulate in their interior. In the latter stages of the malady, the surface of the tumor opens at one or more points, from which there is a discharge of foul sanious matter, with encephaloid substance and clots of blood, and the lymphatic ganglions of the pelvis become enlarged or even affected with fungus hemorrhoides.

I have already intimated that encephaloid of the bladder usually runs its course with great rapidity. The average period at which death occurs may be stated at about twelve months. Occasionally, however, life is prolonged to eighteen or twenty months, and in a few instances even to the fourth or fifth year. Brodie² states that he has known the disease to be protracted for seven or eight years.

What influence age, sex, occupation, mode of life, and other cir-

¹ *Outlines of Pathology*, p. 541. London, 1836.

² *On the Urinary Organs*, p. 107. Second edition. London, 1835.

cumstances exert upon the production of this disease, has not been satisfactorily ascertained, owing, not so much to its infrequency, as to a want of proper details of the cases of it upon record. Thus far it has been observed principally in men after the fiftieth year. In women, it is generally associated with fungus of the uterus, vagina, or rectum. Concerning the *exciting causes* of it we are also in complete ignorance. In a few instances it has been traced to the effects of external violence, as a blow, fall, or kick on the perineum, groin, or pubic region; but, in the great majority of cases, no reason whatever can be assigned for its occurrence.

The most prominent *symptoms* of this malady are local distress, frequent micturition, bloody urine, and a peculiar cachectic condition of the countenance. Let us examine these phenomena somewhat in detail.

The local suffering is always referred to the neck of the bladder, and originally consists merely in a sense of uneasiness; in the progress of the disease it assumes a sharp, darting, or lancinating character, and extends to the neighboring parts, such as the urethra, the perineum, and groin. Sometimes it is felt even in the head of the penis, the sacrum, or loins; and in both sexes it is often accompanied with a sense of weight, warmth, throbbing, or bearing down. It is generally worse immediately after voiding the urine, and is aggravated by pressure on the hypogastric region, by distension of the bowels by flatus or fecal matter, and by rough carriage or horseback exercise. It is worthy of note that, while in most cases the pain is of the most frightful character, in others it is entirely absent, excepting during the last few days of the patient's existence.

The *urine*, which is at first of a dirty turbid appearance, or perhaps even entirely natural, is, in the advanced stage of the disorder, of a dingy brown color, more or less slimy, of an offensive, cadaverous odor, and mixed with fragments of encephaloid matter and clots of blood. Hemorrhage, indeed, is one of the most constant symptoms, and may, when associated with a discharge of cerebral substance, be considered as pathognomonic of the nature of the malady. The blood not only tinges the urine, but generally comes away in large clots or pellets of a dark red, purple or brownish color. Until ulceration sets in the hemorrhage is usually very slight; after this occurrence it is always more profuse, and frequently so constant as to lead to great if not fatal exhaustion. In addition to these symptoms there is sometimes retention of urine, from the

tumor plugging up the mouth of the urethra. Clots of blood or pellets of encephaloid matter may also become arrested in the passage, and so produce similar effects.

In the latter stages of the disease there is an aggravation of all the symptoms. The pain is more constant and severe, the micturition more frequent and distressing, the hemorrhage is more copious, the urine, more turbid and offensive, is generally mixed with purulent matter and tenacious mucus, the digestive powers are sensibly impaired, the sleep is disturbed and unrefreshing, the strength rapidly declines, the countenance assumes a sallow, cadaverous appearance, and the patient at length dies hectic and exhausted.

In this enumeration of the symptoms of encephaloid of the bladder, reference has been made to several signs which are generally regarded as sufficiently *characteristic* of its existence. These are, first, uneasiness about the neck of the bladder; secondly, frequent desire to micturate; thirdly, a bloody state of the urine; fourthly, a discharge of cerebral matter; and, fifthly, a peculiar hue of the countenance, indicative of what is termed the cancerous cachexy. When all these symptoms are present, no reasonable doubt can be entertained respecting the nature of the case. Still, as he is constantly liable to err, the practitioner should never rest satisfied until the bladder has been thoroughly explored by the sound. Should no calculus be detected, it will afford additional proof of the existence of encephaloid. The operation, it may also be stated, is generally attended, in the latter case, with considerable hemorrhage. The tumor can often be perceived by the finger introduced into the rectum, and the local distress is always aggravated by this kind of exploration.

From the history of this affection, as occurring in this and other organs, it may justly be regarded as one of the most malignant which the practitioner is called upon to treat. In no instance, so far as my information extends, has the patient derived any but the most transient benefit from the various curative measures that have been suggested for its relief. Nor is it likely, judging from the peculiar organization of encephaloid, that it will ever become amenable to the resources of surgery. To mitigate the suffering is all that can be done. With this view, the strictest attention should be paid to the patient's diet, the bowels should be kept in a soluble state, the secretions of the skin, kidneys, liver, and mucous membranes should be duly regulated, rest in the recumbent posture should be enjoined, and the pain should be assuaged by morphia, cicuta, and other seda-

tives. Where the local uneasiness is very great, the frequent use of the hip-bath and opiate suppositories will be found eminently serviceable, and ought never to be neglected. Laudanum and starch enemata are less beneficial, because, from the constant straining which accompanies micturition, they are rarely retained long enough to answer the purpose for which they are exhibited. To check the hemorrhage, which is almost always considerable, especially after ulceration has set in, the acetate of lead, nut-gall, the muriated tincture of iron, the sulphate of quinia, and the mineral acids are our best medicines. With the same view the following formula, recommended by Mr. Coulson, may be used:—

R.—Infus. rosæ comp. ℥vj.
 Pulv. aluminis ʒss.
 Pulv. gallarum ʒiss.
 Acid. sulph. dil. ʒj.—M.

Of this mixture two tablespoonfuls are to be administered every four hours. In addition to these measures, recourse may be had, in obstinate cases of hemorrhage, to injections of the acetate of lead, or sulphate of alumina, and some bland mucilaginous fluid, in a tepid state.

ILLUSTRATIVE CASES.

CASE 1.¹—*Frequent and painful micturition; bloody urine; involvement of the prostate gland and ureters; encephaloid deposits in the liver and lungs.*

A pauper, sixty-eight years of age, had labored under an affection of the bladder upwards of five years, and during the last six months he had suffered the most excruciating pain in the pelvic and lumbar regions, attended with almost constant inclination to void his urine, which was effected with the greatest difficulty, either by drops, or in a very small stream, and generally colored with blood. There was also great pain in the rectum, which was much aggravated by costiveness, and the prostate gland was enlarged and tender on pressure. A catheter of the smallest size entered the bladder with the greatest difficulty. A few days before he expired, the patient passed scarcely anything but blood, and the efforts of the bladder were of the most violent and distressing character.

On dissection, the bladder was found to contain a tumor as big as a large orange, composed principally of loose coagula, mixed with a white pulpy substance. Its origin was derived mainly from the prostate gland, especially its middle lobe; but a portion of it, which was dense and hard, projected backwards over the lower surface of the bladder, and plugged up completely both ureters. The orifice of the urethra was also nearly closed. The excretory tube of the right kidney, which was large and very pale, was dilated in its whole extent, and had given way about the middle of its course. The left kidney was natural; but its pelvis and ureter were greatly distended with turbid, fetid urine. The peritoneum was inflamed, and contained three pints of

¹ Langstaff, Cases of Fungus Hæmatodes, London Medico-Chir. Trans. vol. viii. p. 279.

offensive-smelling fluid, mixed with blood. A number of small tumors, similar in their texture and color to that of the bladder, existed in the liver and lungs.

CASE 2.¹—Frequent and difficult micturition; bloody urines; frequent hemorrhages; fracture of the thigh-bone and of one of the ribs; carcinoma in the lymphatic ganglions of the abdomen.

C. Askey, coachman, sixty-three years old, had been afflicted for several months with severe pain in the left hip, pelvis, and loins; continual uneasiness in the head of the penis, and frequent desire to make water, which came away with difficulty, and sometimes blended with a considerable quantity of blood. Long suffering and frequent returns of profuse hemorrhage had already reduced the patient to extreme emaciation and debility. No calculus could be detected with the sound, and the suffering was never increased by exercise. Death occurred on the 20th of November, from copious hemorrhage of the bladder; but a few days before, while turning himself in bed, the patient broke his left thigh.

The bladder contained about six ounces of turbid brown urine, and nearly as much coagulated blood. On the inner surface of the fundus of the organ, directly behind the pubes, was a hard, firm tumor, exceeding a crown piece in diameter, from which the copious bleedings had evidently taken place from time to time during the last five months of the patient's life. The kidneys were healthy; but the ureters were very much dilated, thin, transparent, and greatly distended with urine. All the lymphatic ganglions, in the vicinity of the abdominal aorta, were enlarged, and converted into a hard scirrhous substance. A similar substance surrounded the ends of the fragments of the broken femur, and also those of the fifth rib on the right side, which was accidentally found to have been fractured.

CASE 3.²—Frequent micturition, with discharges of blood; the tumors perceptible to the hand and eye; involvement of the lymphatic ganglions of the pelvis.

A woman, aged fifty-seven, had a smarting uneasiness in making water, which in six months excited severe straining, accompanied, when the bearing down was at all violent, with a discharge of blood. There were pains about the loins and hips, especially on the left side; the inclination to urinate was renewed every ten minutes, the local distress daily increased, the pulse was small, feeble, and 120 in a minute, and a tumor within the abdomen was manifest to the hand and eye. Fever and watchfulness now ensued, and the patient died gradually exhausted. On laying open the abdomen, the lymphatic ganglions of the pelvis and lumbar region were found in a state of carcinomatous enlargement, many of them being of the size of a hen's egg, and adherent, at various points, to the small intestines. The bladder was occupied by a congeries of tumors, seated in the submucous cellular tissue, which was very dense and firm, as well as much thickened. The quantity of disease varied at different points. Posteriorly and at the sides it was from two to three inches in thickness, while in front it was not more than twelve lines. It was made up principally of a soft, white, pulpy matter, interspersed with a cream-like substance. Many of the smaller tumors contained coagulated blood.

CASE 4.—Frequent and painful micturition; purulent and bloody urines; scabulous incrustation of the mucous membrane.

Mr. Howship³ was requested to visit a female, aged seventy-nine, who had long felt uneasiness about the bladder, and now complained of constant desire to pass

¹ Samuel Cooper, London Medico-Chir. Trans. vol. xvii. p. 51.

² Howship, A Practical Treatise on the Urinary Organs, p. 198.

³ *Op. cit.* p. 194.

water, which was of a turbid, purulent nature, voided in the smallest quantity, and sometimes streaked with blood. The complaint had for the last two months advanced imperceptibly, but now allowed neither sleep nor comfort. Sometimes there was difficulty in micturition, accompanied with darting and cutting pains in the part. The bowels were habitually regular. Pressure against the bladder, by the finger in the rectum, caused great suffering, and a sensation similar to that experienced in passing water. She expired the day after Mr. Howship first saw her. The bladder contained a little thick bloody urine, and irregular masses of sabulous deposit, with a considerable quantity of pulpy, brain-like matter, decomposed and putrid at some points, and of a cream color, firm consistence, and vascular texture at others. Several of the tumors exactly resembled fungus hæmatodes in their appearance. One, which lay on the left side, towards the posterior part of the bladder, was of the diameter of a five-shilling piece, and in a state of ulceration, with a ragged, pulpy cavity. The mucous lining towards the origin of the urethra was unnaturally red, and incrustated with sabulous matter.

CASE 5.—Constant and painful micturition; frequent discharges of blood; obliteration of the cavity of the bladder by the morbid growth.

Dr. E. Bissell,¹ of Norwalk, Connecticut, has described an extraordinary instance of this disease in a man, sixty-seven years of age, who had enjoyed uninterrupted health until April, 1842. About this period he was seized with irritation in the bladder and constant inclination to urinate, attended with frequent discharges of blood, and agonizing pains, which finally produced exhaustion and death. The tumor, which could be felt through the rectum and the abdominal walls, was of an ovoidal shape, and nine inches in the vertical direction by four and a half in the transverse. It originated near the neck of the bladder, and was of the real encephaloid character. Its texture was soft, pliable, and easily torn with the finger. The organ was so completely filled with it that it was unable to hold the smallest quantity of urine. The kidneys and other viscera were sound.

CASE 6.—Bloody micturition; occasional discharge of decomposed substance; obliteration of the cavity of the bladder by the morbid growth.

A man who had been repeatedly sounded for stone entered the Hôtel-Dieu of Paris, under the care of Desault.² He had felt for some time past fixed and lancinating pains in the region of the bladder, which gradually augmented in violence, and were accompanied by bloody micturition, troublesome itching at the end of the penis, and an occasional discharge of pellets of putrefied flesh from the urethra. The flow of urine became more and more difficult, a catheter could hardly be passed into the bladder, and the patient at length died worn out with marasmus and horrible suffering. The tumor, originating from the neck of the bladder, was larger than two fists, and filled the whole cavity of the viscus.

CASE 7.³—Constant discharge of blood; inability to introduce the catheter; effacement of the cavity of the bladder; cancerous matter in the pelvic veins.

An old man was admitted into the surgical ward of the Bicêtre of Paris, in 1834, for retention of urine. There was almost a constant discharge of nearly pure blood from the urethra. The patient was much emaciated, and a circumscribed tumor could be plainly felt in the hypogastric region. Various attempts were made to draw

¹ American Journ. Med. Sciences, New Series, vol. vii. p. 122. 1844.

² Surgical Works, by Smith, vol. ii. p. 153. Phila. 1814.

³ Mercier, Recherches sur les Maladies des Organes Urinaires et Génitaux, p. 184. Paris, 1841.

off the urine with the catheter, but without success. After death the cavity of the bladder was found to be almost entirely effaced; its posterior wall was occupied by a cancerous tumor larger than a fist, and composed of encephaloid tissue. The free surface of the morbid mass was fungous, and of a blackish color. The muscular fibres were red and hypertrophied; and near the summit of the bladder the peritoneum was raised into several prominences which had been distinguished during life across the attenuated parietes of the abdomen. Cancerous matter was found in the neighboring veins. All the other viscera were sound.

CASE 8.—Frequent and painful micturition, with great distress along the urethra and at the head of the penis; bloody urine; coexistence of urinary calculus.

A man, aged forty, was admitted into St. Mary's Hospital, London, on the 11th of January, under the care of Mr. Coulson.¹ He had been afflicted with uneasiness in passing urine as long as he could remember, but it was only during the last two months that he had experienced great distress, and that his general health had begun to give way. He now complained of great pain along the urethra and at the head of the penis, especially after micturition, and also of a good deal of uneasiness in the lower part of the abdomen; his urine, which he was obliged to void very frequently, was always bloody, and contained crystals of the triple phosphates, but no cancer-cells. The sound readily detected a calculus. The countenance was pale, and expressive of great suffering. The lateral operation being performed, two calculi were extracted, but not without some difficulty, owing to the fact that the larger one was pushed up towards the right side of the bladder, where it lay in a kind of sulcus, formed by a tumor. There was a good deal of venous hemorrhage during the operation, which the patient survived only two days. The bladder was found to be adherent to the surrounding structures, and its cavity was occupied by a medullary growth, yielding, on pressure, a soft brain-like substance, and exhibiting, under the microscope, the true cancer-cell.

CASE 9.—Intra-mural situation of the tumor; bloody urine; encephaloid deposits in the liver, heart, and lungs.

Fungus hæmatodes is occasionally developed between the peritoneal and muscular coats of the bladder. The following case of this occurrence is related by Mr. Bulley, in the *London Med. Gazette* for October, 1845. The tumor was as large as a middle-sized cocoa-nut, and extended from the fundus of the organ along its posterior surface to within three-quarters of an inch of the prostate gland. The upper portion of the mass was in a state of softening, easily broken down, and intermixed with pus; in the middle it closely resembled healthy brain, and at the lower part it was of a firm, fibrous, almost scirrhus consistence. The patient was a man forty years old. The urine had passed hitherto in small quantity, and was invariably mixed with blood. The tumor pressed upon the rectum to a great extent, and was thus probably the cause of the anasarvous condition of the parts about the anus. Encephaloid deposits were found in the lungs, liver, and the interior of the heart.

Of the above cases seven occurred in males and two in females. The ages varied from forty to seventy-nine, no mention being made of them in two. In a majority of the cases the disease coexisted with encephaloid in other structures, and in all, except one, it was attended, especially during its latter stages, with a discharge of

¹ *London Lancet*, vol. i. p. 373, April, 1854, Am. ed.

bloody urine. In several, indeed, there were occasionally quite copious hemorrhages; another prominent symptom was frequent and painful micturition, with great distress in the pelvic region, the neck of the bladder, and the urethra. In eight of the cases, the heterologous matter occupied the cavity of the bladder, while in one it was situated between its peritoneal and muscular tunics.

SECTION III.

COLLOID AND MELANOSIS OF THE BLADDER.

Colloid and melanosis have never been observed, so far as I know, in the urinary bladder. That they do, however, occur here appears not improbable, especially when it is recollected that both these varieties of cancer are occasionally developed in some of the other mucous cavities. Be this as it may, they must be exceedingly rare; and, as we are entirely ignorant of their history, in relation to the organ in question, no further notice need be taken of them in this place.

SECTION IV.

TUBERCULAR DISEASE OF THE BLADDER.

The bladder is sometimes the seat of tubercular disease. The deposit is commonly met with in the form of minute granulations, similar to those which occur in the bowels and the air-tubes. They are of a pale yellowish color, rounded or spherical in their shape, of a semi-concrete consistence, and of the size of a radish-seed or a small shot. Their number is generally small. It is probable that they may occur in any part of the bladder; but they are by far most common in the neck and bas-fond of the organ.

The *seat* of this deposit is in the mucous follicles, in the substance of the mucous membrane, and in the submucous cellular tissue. In some instances, especially when the granulations are numerous, the heterologous matter can be shown to exist simultaneously in all these situations. Each tubercle, while in a crude state, is surrounded by a delicate vascular network, which contrasts so much the more strikingly with the neighboring parts, inasmuch as these are almost always perfectly healthy. After these bodies have existed for an indefinite period, they begin to soften, and are finally entirely broken down and expelled, leaving in their stead

so many small, roundish ulcers, with thin, ragged, and undermined edges, precisely as in the larynx, trachea, and alimentary canal.

Tubercular disease of the bladder is generally, if not invariably, *associated* with the same deposit in other parts of the body, especially the kidney and the prostate gland. Its coexistence with tubercular disease of the lungs is uncommon. Dr. Lombard, of Geneva, noticed it only once in one hundred autopsies. Louis does not record a solitary instance of it in connection with his three hundred and fifty-eight cases of pulmonary phthisis. Rilliet and Barthez make no mention of the coincidence in their dissections, which amounted to three hundred and fourteen. In my own examinations I have noticed only two examples of it, the details of which will be appended below. In another instance in which I observed this disease, death was produced by a psoas abscess, the lungs being perfectly sound. A considerable quantity of tubercular deposit, however, existed in the kidneys, the prostate gland, and the seminal vesicles.

It is not known what influence, if any, age, sex, temperament, habit, climate, and occupation exert upon the production and progress of this disease. The probability, however, is that the same laws are in operation here as in tubercular deposits in other parts of the body.

There are, unfortunately, no *symptoms* by which we can, with any certainty, determine the existence of tubercular disease of the bladder. As long as the deposit remains in a state of crudity, there is, in general, merely a slight degree of irritability of the mucous membrane, with increased frequency of micturition; but these effects do not differ in any respect from those produced by ordinary causes. In a case described by Dupuytren, the symptoms resembled those of stone, and this eminent surgeon actually cut his little patient, a boy two years and a half old. When the softening process has commenced, the peculiar matter of tubercle is discharged along with the urine, in which it can often be detected with the naked eye. Where any doubt exists concerning the true nature of the purulent fluid, a small quantity of it should be placed under the microscope. If it be tubercular, it will be distinguished by the peculiar character of its corpuscles, which are much larger than those of ordinary pus, of a whitish-yellow color, and of a lenticular, round, or oval form, with jagged edges, and concentric rings. These circumstances, added to the history of the case, and the fact that the patient generally experiences, at this stage of the

affection, severe pain and spasm at every attempt at micturition, will go far in clearing up the diagnosis.

It has already been stated that softening of the tubercular matter is liable to be followed by ulceration of the lining membrane. The subjoined cases, three of which have occurred in my own practice, will serve to place this subject in a clearer light.

CASE 1.—Obscure urinary symptoms; psoas abscess; strumous diathesis; ulceration of the bladder; tubercles in the kidneys, the right ureter, seminal vesicles, and prostate gland; absence of pulmonary disease.

A young man, twenty-seven years of age, an inmate of the Cincinnati Hospital, after having labored under psoas abscess for four years, finally died of this disease in a state of complete exhaustion. He had been naturally feeble all his life, and his features were strongly indicative of the strumous diathesis, his skin being very delicate, and his eyes and hair light. Although there was, as will presently be seen, most serious lesion of the kidney and urinary bladder, there were not, at any time, any symptoms which could strictly be referred to the urinary apparatus. The renal secretion was, perhaps, a little less abundant than natural, but the man had no difficulty in retaining his urine, and never complained of the slightest pain, soreness, or scalding in voiding it.

On dissection, I found upon the mucous membrane of the bladder five distinct ulcers, in close proximity with each other, the largest of which was twelve lines in length by six lines in width, while the smallest did not exceed the diameter of a split pea. They had a rough, uneven appearance, and were evidently of a tubercular character. Situated around the mouth of the urethra, they were nearly all of a circular shape, with red, elevated, and slightly undermined edges, their base being formed by the submucous cellular tissue. In several of them it was evident that an effort had been made at reparation, small bands of lymph, strongly adherent, and apparently organised, having been extended across their surface from one margin to the other. The bladder was very much contracted, and contained about two ounces of thick, purulent fluid.

The right kidney was literally crowded with tubercles, several hundred, from the size of a mustard-seed to that of a small cherry, being contained in the cortical substance alone. They were of a white, opaque appearance, semi-cartilaginous in their consistence, and either isolated or closely agglomerated in their arrangement. Externally the kidney had a dark mottled aspect; while in its interior were two tubercular excavations, one of which occupied the lower half of the organ, and was about the size of a turkey's egg; it was filled with thin, ropy pus, lined by a thick stratum of lymph, and intersected by four rounded cords, the remains, probably, of the tubular structure. The viscus itself was very little increased in bulk and weight. The left kidney contained hardly any tubercular matter, while the right ureter and the seminal vesicles were nearly filled with it. The same substance was also found in abundance in the lymphatic ganglions of the pelvis, and in smaller quantity in the interior of the prostate gland. What is remarkable was that the lungs were entirely free from this deposit, the most thorough scrutiny having failed to detect the least particle of it. All the other viscera were sound.

Whether the urinary lesion in this case was masked by the lumbar abscess, or whether this exemption from suffering is peculiar to this form of ulceration, is a point which I am unable to determine. The subject is worthy of further inquiry.

CASE 2.—Irritability of the bladder; frequent micturition; hæmaturia; frequent morbid erections; urine loaded with mucus, and, at times, with sandy matter; general health much disordered; ulceration of the bladder; tubercles of the prostate gland, the left kidney, and the lungs.

Mr. S., aged twenty-seven years, a native of Alabama, but for a long time a resident of Kentucky, and a lawyer by profession, was one of nine children, all of whom, except himself, were healthy and of good constitution. In the autumn of 1848 he had a severe attack of fever, which greatly prostrated him, and confined him to his bed and room for nearly four months. Soon after he was able to go about, he perceived a tingling sensation at the end of the penis, and, occasionally, a slight discharge of blood after passing water. The latter ceased in about three weeks, but soon reappeared, and was again arrested by treatment. He remained feeble during the whole winter. In March, 1849, while still indisposed, he went to Texas, travelling much of the way on horseback, and being often exposed to cold and wet. During the whole of his journey he suffered a good deal from morbid erections and irritation of the urethra. In the latter part of May, his former symptoms returned; and he now experienced, in addition, a desire to pass his water several times at night, as well as more frequently during the day. In the course of a few months he was obliged to relieve his bladder regularly as often as twenty times in the four-and-twenty hours; the discharge of blood also increased in quantity; and the erections of the penis became both frequent and painful, being often followed by involuntary emissions, which continued up to within a short period of his death. At times he had difficulty in starting the flow of urine, but, when it had once begun, it usually continued until the bladder was completely emptied.

Early in December, 1849, the patient began to discharge clots of blood, usually of the length, shape, and diameter of the urethra; this occurrence continued, with various intermissions, for a whole year, and was generally followed by marked relief of the vesical distress.

In January, 1850, the urine was observed to contain an unusual quantity of thickropy mucus, resembling the white of eggs, attached to the bottom of the chamber, and often amounting to a spoonful in the twenty-four hours. The bladder was now exceedingly irritable, and the patient could never stand up without an urgent desire to void his urine. Lying or sitting, he had much greater control over the organ, and suffered much less pain. In the succeeding summer, clots of blood and fibrin, generally mixed with pus, were occasionally passed, and usually with some relief. The urine also deposited a considerable quantity of white earthy matter, which continued to form until the patient's death.

The general health, during all this time, was more or less disordered; the bowels were habitually constipated; and the patient rarely slept more than two or three hours in the night. During the last twelve months, he experienced severe pain in the sacro-lumbar region, and so much distress and soreness in his inferior extremities that he could seldom remain long in the same posture. He also had frequent pain, evidently of a neuralgic character, in the muscles of the left side of the chest and shoulder. In March, 1851, he began to suffer from pain in the region of his kidneys, which was often very violent, and was always increased by pressure and by motion. Various remedies were employed for his relief, but without much benefit; his suffering steadily progressed, and he expired, completely exhausted, on the 21st of July, 1851.

The body was examined, soon after death, with the assistance of Dr. Durett and Dr. Bartlett, resident pupils of the Louisville Marine Hospital.

The bladder was contracted to the volume of a hen's egg, and contained a few drops of reddish urine, along with some flakes of mucus. Its walls were somewhat thickened, especially in front and below. The external surface was perfectly smooth and

natural. On laying open the bladder, a large ulcer was discovered, extending from the neighborhood of the mouth of the urethra nearly as high up as the orifices of the ureters; it almost encircled the neck of the organ, and was about the size of half a dollar, of an oblong shape, superficial, and of a pale yellowish color. In front of the ulcer, the mucous membrane terminated abruptly by a well-defined edge, while just behind it, it presented numerous granulations, of the size of a small pin-head, and of a light reddish hue. The summit of the viscus was perfectly normal. The lining membrane was everywhere of good consistence, and, in great degree, free from inflammatory turgescence. The gallinaginous crest was unnaturally small.

The prostate gland was very hard, and about one-third below the normal bulk; each lobe, at its posterior and middle part, contained a small quantity of tubercular matter, in a crude state, and of a yellowish color. The seminal vesicles, especially the left, seemed to be a little smaller than usual, but in other respects they were natural. The right contained a little seminal fluid.

The right kidney was five inches and a half in length, one inch and a quarter in thickness, and two inches and a third in width at the centre; its weight being upwards of six ounces. Its form was unaltered. Its fibrous envelop adhered closely to the outer surface of the organ. The cortical substance was unnaturally developed, and firm in consistence, but not lacerable, and of a brownish color; it was pervaded by large vessels, and bled freely on being divided. The tubular structure was normal, as was also the lining membrane of the pelvis and of the corresponding ureter.

The left kidney weighed three ounces and a half, being four inches in length, one inch and three-quarters in width, and not quite one inch in thickness. It was of an irregular shape, puckered on the surface, very hard, and firmly adherent to its fibrous covering. A section of it disclosed an abundance of thick, whitish tubercular matter, in a softened state, and pervading the entire gland. The tubular substance and mammillæ were almost entirely absorbed. The cortical structure, on the contrary, was unusually distinct, abnormally pale, and of semi-cartilaginous hardness, grating almost under the knife. The pelvis and ureter, the latter of which was somewhat dilated and thickened, were nearly filled with tubercular matter, easily separated from the mucous membrane, which was pale and apparently healthy. The supra-renal capsules were uncommonly small, but natural in other respects.

The stomach, bowels, spleen, liver, gall-bladder, and pancreas were sound. The heart was small and flabby; the pericardium was free from fluid.

The right lung, everywhere adherent to the walls of the chest and the diaphragm by old and firmly organized membrane, was filled throughout with miliary tubercles, isolated, and grouped together, crude, and of a yellowish color. Nearly the whole of the parenchymatous substance was consolidated, and so much disorganized as to yield under the slightest pressure of the finger. The left lung was also stuffed with tubercles; and near its apex was a small cavity, scarcely as large as a hazelnut, and occupied with pus. The left pleuritic cavity contained about one ounce of clear, yellowish serum. The bronchial glands were unusually dark and somewhat enlarged, but free from tubercular deposits. The bronchial tubes were healthy.

CASE 3.—*Great irritability of the bladder, with frequent micturition; scanty mucus, and purulent urine; excessive emaciation; destruction of the mucous membrane of the organ; tubercular matter in the left kidney and ureter, the Fallopian tubes, the left ovary, and the lungs; ulceration of the large bowel.*

Bethel Miller, a seamstress, aged twenty-four, was admitted into the Louisville Ma-

¹ I am indebted for the history of this case to Dr. William H. Lyle, my assistant at the Louisville Marine Hospital.

rine Hospital on the 1st of November, 1854, on account of rheumatism and disease of the bladder. Her mother is still living, but her father died three years ago, after having labored for a long time under symptoms of vesical calculus. None of her relations have suffered from phthisis or malignant disease. She began to menstruate at sixteen, and continued to be quite regular, in this respect, up to within six months of her death. Until the age of eighteen, when she had a mild attack of varioloid, her general health had always been remarkably good. She was married at nineteen, and has had two children, both of whom died young.

Twelve months after her marriage, and about ten days after the birth of her first child, she had an attack of measles, which proved nearly fatal. She became again pregnant, and about six months after her confinement she began to suffer from inflammatory rheumatism, which was principally limited to the left knee, and troubled her more or less for some time. About a year ago, she had an attack of acute pleurisy. The disease assumed a chronic character, and she made a tardy recovery. The left side of the chest became contracted, and she inclined constantly towards that side in walking and sitting. Pulmonary symptoms set in; she was teased with cough and shortness of breathing; there was constant expectoration of mucus, frequently tinged with blood; the appetite and strength began to decline; the stomach was irritable; and the chest was the seat of a dull, heavy, aching pain.

In July, 1854, she had another attack of rheumatism, which was renewed, with increased violence, about the middle of October. It was, as already stated, on account of this attack that she was received into the hospital on the 1st of November. Her symptoms continued, with little abatement, until about the 20th of the month, when they began to subside; but now, instead of convalescing, she was seized with urinary difficulty, attended with the discharge of gravel, a frequent desire to urinate, and great pain in the bladder, extending to the groins, thighs, and sacro-lumbar region. On the 5th of December, she was transferred to the surgical ward, and placed under my charge.

I found her much emaciated, and so greatly debilitated that she was unable to rise from the bed; she had a morbid appetite, and a desire for acid drinks, with a feeble digestion, an aversion to animal food, and a troublesome cough. About this time, hectic fever made its appearance, generally coming on towards evening, and attended with severe headache. The pain in the bladder gradually augmented in severity, the micturition became very frequent, and she was seldom able to retain more than an ounce of urine at a time, which was usually voided with great suffering. The fluid was found to be acid, and surcharged with mucus and pus, but free from sabulous matter. Her rest was much disturbed by her local distress, and she was obliged to make frequent use of anodynes to procure sleep.

About ten days before she expired, her stomach became again exceedingly irritable; she lost all desire for food; the voice began to fail; the urinary distress augmented; and a profuse diarrhoea set in, resisting all the remedies which were directed for its relief. She died, completely worn out, on the 27th of December, not quite two months from the time of her admission.

It is not necessary to specify the treatment of this case after it fell into my hands. It is sufficient to say that a great variety of means were employed, with apparently little or no relief, save what was afforded by the anodynes, which were given, for a time, both by the mouth and the rectum.

The body was inspected ten hours after death, with the assistance of Dr. W. H. Lyle and Dr. J. W. Powell. The bladder was contracted to the size of a small apple; its coats were considerably thickened, as well as indurated; and the mucous coat was completely destroyed, except at two points, the larger of which was an inch in length, by about half

an inch in width, and occupied the posterior part of the organ. The color of these spots was of a deep claret, and contrasted beautifully with that of the surrounding surface. The muscular fibres were incruusted by organized lymph, of a whitish aspect, and raised into numerous little prominences, between some of which their substance was very distinct, as if it had been exposed by the scalpel. The neck of the organ was considerably thickened, and just behind it, on the left side, the coats were unusually firm and dense, inelastic, and of a grayish color. The orifices of the ureters were unnaturally large.

The right kidney was sound, but the left was somewhat enlarged, and exhibited a singularly bosselated appearance. On laying it open, it was found to contain eight distinct cavities, varying in size from that of a bean to the end of the thumb, and occupied by thick, cream-colored pus and crude tubercular matter. Nearly the whole of the parenchymatous substance was destroyed. The supra-renal capsule was healthy. The ureter was as large as a little finger, and not more than nine inches in length, its coats being very much thickened and indurated, while its inner surface was lined by a layer of tubercular substance, of dense consistence and a whitish color.

The uterus was normal. The Fallopian tubes were filled with strumous matter, and the left ovary contained a solitary crude tubercle. The rectum, in its whole length, and the lower portion of the colon, were covered with ulcers, evidently of a follicular character. A few tubercles were visible in the subserous cellular tissue of this division of the bowel. The rest of the alimentary tube was sound, as were also the liver and spleen. The lungs, especially the left, contained numerous tubercles, most of them in a crude state, and the latter had contracted extensive adhesions to the walls of the chest. A few of the bronchial ganglions were enlarged and tuberculous. The heart was natural.

CASE 4.¹—Excessive pain and irritability of the bladder; purulent and bloody urine; great emaciation; agonizing pain in the right labium and right side of the pelvis; almost complete destruction of the mucous coat of the bladder; tubercles of the left kidney.

Margaret Marshall, aged fifty-seven years, a native of London, and married thirty-four years, but without children, became affected on Christmas, 1840, with pain in the region of the bladder, attended with frequent and painful micturition. When she was admitted into King's College Hospital, on the 30th of June, under the care of Dr. Budd, she was considerably emaciated, and complained, in addition to the above symptoms, of a burning pain at the orifice of the urethra, in the left labium, and in the ramus of the pubes. The urine, which was voided in small quantity at a time, was acid, slightly albuminous, and mixed with pus. An examination with the catheter caused severe pain; and she complained of great tenderness when the finger, passed into the vagina, was pressed against the bladder. She had no sleep or appetite; her thirst was great, and there was considerable irritative fever. The emaciation gradually increased, and she died, completely worn out by pain and suffering, on the 8th of October. Towards the last, the urine frequently contained, in addition to the pus, a small quantity of blood. She complained throughout of agonizing pain in the left labium and in the left side of the bladder: and always lay on her right side, for the sake, as she said, of easing it. She had no pain in the right labium, or in the loins. During the whole of her stay in the hospital she had occasional vomiting, and constipated bowels; the effect, no doubt, of the large doses of morphia which she was constantly obliged to take to mitigate her distress.

The bladder, on dissection, was found to be quite denuded of mucous membrane,

¹ London Medical Gazette, for 1841-42, p. 358.

except at a space about the size of a shilling on the posterior surface, immediately within the urethra, and at a very small spot around the orifice of the right ureter. The muscular fibres, which were thus exposed, exhibited no trace of ulceration, and were nearly of their natural appearance. The left half of the bladder was not more diseased than the right, except that the mucous membrane was entirely destroyed about the orifice of the left ureter. A few very small, whitish points, not unlike tubercles, were seen upon the mucous membrane at the back part of the urethra, the whole surface of which was quite vascular. The left kidney contained a number of tubercles in its cortical substance, some in a softened and others in a concrete state; and the mucous membrane of the corresponding ureter was very much thickened, rough, and ulcerated. The right kidney and ureter were healthy. All the other viscera, pelvic, abdominal, and thoracic, were in a natural condition.

CASE 5.—Excessive irritability of the bladder; bloody and purulent urine; usual symptoms of stone and phthisis; profuse diarrhoea; ulceration of the bladder and urethra; tubercular disease of the kidneys; abscess between the bladder and rectum.

A boy, aged fourteen, a patient of Mr. Ferrall,¹ of Dublin, was admitted into St. Vincent's Hospital of that city, worn out with disease of the bladder. He had been obliged for some time past to void his urine every half hour; and he had also the usual symptoms of phthisis, as cough, night-sweats, emaciation, and purulent expectoration. The pain in the bladder was frequently very acute, especially during micturition; and the urine, which was at first acid, and then alkaline and purulent, was occasionally mixed with blood. A short time before death, it passed off involuntarily, and exhibited distinct traces of albumen. The prepuce was elongated, and so much did the symptoms resemble those of stone in the bladder that the boy was repeatedly sounded. Finally, he was attacked with profuse diarrhoea, which lasted about a week, and which produced a most remarkable change in the urinary irritation; the pain and desire to pass water, as well as the purulent and bloody discharges, being greatly diminished, but reappearing immediately on the cessation of the purging, with even increased intensity.

The ulceration had attacked almost the whole of the mucous membrane of the bladder, and extended some distance into the urethra. The kidneys presented the strongest marks of tubercular disease, and their cortical substance appeared to be altogether destroyed. There was a large abscess between the bladder and the rectum, but it had not formed any communication with either of these cavities.

CASE 6.—Excessive irritability of the bladder; frequent micturition; purulent and bloody urine; symptoms of calculus; abscess in the right iliac fossa; ulceration of the bladder; tubercular disease of the kidneys; peritonitis.

A boy, eleven years old, was admitted, November 9, 1858, into St. George's Hospital, under the care of Mr. Cutler,² on account of disease of the bladder. He had many of the symptoms of stone, having labored for the last twelve months under frequent calls to void his urine, which was very thick, purulent, alkaline, and occasionally even bloody. Every attempt to empty the bladder was attended with extreme pain, and the passage of the fluid was sometimes suddenly interrupted, as if the entrance of the urethra had been blocked up by some foreign body. Latterly the boy was obliged to relieve himself every ten minutes; he was pale and thin, and had an unusually long prepuce. On introducing a sound, the bladder was found to be rough and much contracted, but no stone could be felt.

¹ Dublin Journal of Medical Science, vol. xvi. p. 844. 1840.

² London Lancet for April, 1854, p. 865. Amer. ed.

Early in December an abscess was noticed in the right iliac fossa, which gradually came forward, and at length pointed just above Poupart's ligament, near the antero-superior spinous process of the ilium. No marked symptoms attended its formation, but the boy became gradually more thin and feeble, and died, completely exhausted, seven weeks after admission.

The bladder was divided by a horizontal septum into two cavities communicating by a small opening. The mucous membrane had almost entirely disappeared; the muscular fibres were greatly thickened and fasciculated; and at the posterior part of the superior chamber, just alluded to, was a rounded hole, which completely pierced the wall of the organ, but had evidently been occluded by the bowel. The cellulo-adipose tissue around the base of the bladder was very much indurated. The kidneys were much diseased; one being literally filled with scrofulous matter, while the other contained pus, tubercles, and calcareous substance. The abdominal cavity exhibited all the evidences of high inflammation, there being recent deposits of lymph, and a large accumulation of purulent fluid. All the other viscera were sound.

In studying the preceding cases, we are struck with the similarity of many of their symptoms. The prominent suffering in all was excessive irritability of the bladder, with a frequent and gradually increasing desire to urinate, and more or less pain in performing the act; the emaciation was progressive, and death was always preceded by hectic fever, and occasionally by exhausting diarrhoea. The urine in all the cases was purulent, and in four also bloody. Four of the patients were males, and two were females. Their ages varied from eleven to fifty-seven, the average being a little upwards of twenty-six.

The bladder was ulcerated more or less extensively in all the cases, the mucous membrane in several of them being completely destroyed, and the muscular fibres, thickened and even fasciculated, as neatly dissected as if it had been done by the anatomist. The kidneys, one or both, were tuberculated in every instance; the ureters and the urethra suffered in several of the cases; in two there was tubercular matter in the prostate gland, and in one in the seminal vesicles. In two of the cases, one a male and the other a female, numerous tubercles were found in the lungs. One of the patients had psoas abscess, one iliac abscess, and one recto-vesical abscess.

From an examination of the above cases, it may be assumed that, whenever there is very extensive ulceration of the bladder, the disease is of a tubercular character; for I know of no affection, unless it be urinary calculus, which could possibly induce such a result. The malady, in truth, is of the same nature as follicular ulceration of the bowel, so frequent an associate of tubercular phthisis.

CHAPTER VII.

POLYPOUS, FUNGOUS, ERECTILE, AND OTHER MORBID GROWTHS OF THE BLADDER.

VARIOUS morbid growths, not strictly malignant in their character, occasionally occur in the urinary bladder, such, for example, as polypes; but even these are exceedingly rare, and thus far I have not had an opportunity of observing an instance. Dr. Baillie, without particularly describing this heteroclite product, observes that he has seen only one example of it. It filled the greater part of the cavity of the organ, was of a pretty firm texture, and presented a very irregular appearance, being made up of various projecting masses.¹ Numerous cases of this disease are recorded by the older authors. Zacutus Lusitanus found in the bladder of a man who died of retention of urine, a polype of the size of a goose's egg, the interior of which was occupied by a tough glutinous substance. It was situated at the neck of the viscus, and caused great difficulty in micturition. Another, but harder and more fleshy mass, existed in the body of the bladder.² In a man sixty years of age, during the last two of which he had experienced constant pain in voiding his urine, Kirchner,³ a German physician, found the neck of the bladder very much thickened, and occupied by a small fibrinous body, not more than a few lines in length, which projected forwards into the urethra, and thus obstructed the flow of urine. Similar cases are mentioned by Sylvius, Rollin, and other authors. Warner⁴ removed a polype from a young wo-

¹ Works, by Wardrop, vol. ii. p. 264. London, 1825.

² Prax. Medic. Admirab. lib. ii. obs. lxxi. p. 58.

³ Medic. National. Zeitung for 1799, p. 138.

⁴ London Philos. Transact., No. 495, p. 414, 1749; also Warner's Cases in Surgery. In this case, the tumor projected into the urethra, causing retention of urine, for which the catheter was obliged to be constantly used. This was frequently attended with great pain as well as considerable hemorrhage, by which the patient was at length much reduced. The tumor was attached to the lower part of the bladder, near its neck, and could be felt, though not without difficulty, with the finger. The bladder being full of water, and the patient made to strain, the tumor was thus

man which grew from the neck of the bladder into the urethra, so as to cause serious embarrassment in voiding the urine; and an instance of the same kind precisely fell under the notice of Walther,¹ in a girl who died of spasmodic disease.

This disease occasionally exists at a very early period. An exceedingly instructive case illustrative of this fact is recorded by the late Mr. Crosse, in his excellent work on Urinary Calculus, published in London in 1835. When this distinguished lithotomist was first consulted, the boy was only a year and a half old, and the vesical disorder, the most urgent symptom of which was a frequent desire to pass his water, had existed upwards of a month. He was continually wet with urine, which was voided in drops at intervals varying from a few minutes to half an hour, and every effort of the kind was attended with the most violent straining and rubbing of the head of the penis. The rest was constantly disturbed, the body became greatly emaciated, the general health rapidly declined, and the countenance was expressive of the deepest suffering. Under the belief that the little patient was affected with calculus, the bladder was repeatedly sounded by Mr. Crosse and another surgeon, a practitioner of great experience; and finally, when two years old, it was determined that an operation should be attempted for his relief. In opening the membranous part of the urethra, a semi-transparent substance appeared in the wound, resembling the mucus which had passed from the bowel when the child was placed on the table; and for a moment the operator feared he had cut into the rectum. On carrying the knife forward fairly to the neck of the bladder, the incision became instantly filled with a mass resembling, at first sight, the vermiform process and several folds of small intestine, but which, upon further examination, was found to be composed of a cluster of soft polypes, connected to each other and to the inner surface of the organ by a loose, pendulous membrane. They varied in their size from that of a pea up to that of a big grape, the attachment of some being by a narrow neck, of others by a broad base. All that were within sight were cut off

forced down, when it was seized with a crooked needle, and a ligature passed through its substance. An incision was next made into the urethra, when the morbid mass was pulled down, and tied firmly round its base. Some pain of the abdomen followed the operation, but the retention of urine immediately subsided. The tumor, which resembled a turkey's egg in shape and size, dropped off on the sixth day, and the woman soon entirely recovered.

¹ Krankh. der Nieren und Harnblase, p. 80.

with the scissors; many, however, remained, and no material benefit resulted from the operation. Death occurred in forty-four hours, preceded by perpetual straining efforts.

On inspection, the peritoneum was found to be entirely free from inflammation, and the rectum was also uninjured. The cavity of the bladder was still occupied by several tumors, which adhered to the lining membrane at the inferior part of the organ, towards its neck. One large mass with a broad base, firmer than the rest, and situated near the orifice of the left ureter, must have been the resisting body, which, according to Mr. Crosse, was so generally felt on sounding. A few smaller ones, from the volume of a pea to that of a bean, were loose in the bladder. Towards the neck of the viscus the tumors had a different structure, presenting a wart-like, granulated, or tuberculated surface. They were all covered by a reflexion of the mucous membrane, none of which was in a healthy condition, being loose, gelatinous, and thickened, in all parts where there were no polypus, from the orifices of the ureters to the fundus. The neck of the organ and the prostatic portion of the urethra were much dilated, and the narrow base by which the tumors in this situation were attached was so flabby as to allow them to project into the excretory canal, causing the obstruction to the flow of urine, and the unnatural fulness of the perineum before adverted to. The muscular coat was also considerably hypertrophied, the ureters were enlarged and contorted, and at the fundus of the organ, in the subserous cellular substance, was a small abscess filled with pus.

M. A. Petit, of Lyons, once performed the operation of cystotomy on a young woman, in the belief that there was a stone, both he and his friend supposing they had felt one. It turned out, however, to be a tumor, and they agreed that nothing could be done; the patient lived a year after, and on dissection the bladder was found to be occupied by a large pyriform polype with an extremely narrow pedicle.¹ I have already alluded to the case of Warner, in which a tumor of this kind was successfully extirpated from the inside of the bladder.

Various anomalous growths, known by the terms *fatty* and *steatomatous*, are sometimes observed in the bladder, but their occurrence is so rare that it is scarcely necessary here to allude to, much less to describe, them. They seldom attain a large bulk, are generally situated in the bas-fond of the organ, and always exhibit the same

¹ Crosse on Urinary Calculus, p. 49.

structure as in other parts of the body. Interesting cases of this morbid product are recorded by Schäffer,¹ Ludwig,² and Schwertner.³ In the instance mentioned by the second of these writers, the subject was a man, sixty years of age, who died from retention of urine. On laying open the bladder, two tumors were discovered, one of which, movable, and about the size of a filbert, was situated at the right side of the neck of the organ; the other, fixed, and of the volume of an English nut, a little further out. They were both traversed by varicose veins, and were of a fatty nature. In the case recorded by Schäffer, the morbid product was of a steatomatous character; it was of the size of a hen's egg, and lay immediately between the outlets of the ureters, where it could be felt by the finger introduced into the rectum. The lining membrane of the bladder was considerably hypertrophied, especially at the posterior part of the organ, and its inner surface was covered with a thick tenacious mucus. The patient, an old man, had labored for several years under great difficulty of micturition, accompanied with violent straining efforts, uneasiness in the loins, and a sense of weight in the pelvis and perineum. In Schwertner's case, the tumor was also of the steatomatous kind, interspersed with small scirrhous masses; it weighed nearly one pound, and was so voluminous as to encroach very much upon the pelvic cavity, its surface being in a state of ulceration. Frequent micturition, violent pains in the bladder and hip, and bloody urine, were the most prominent symptoms. The patient was a middle aged man.

The bladder is sometimes the seat of a peculiar *fungous growth*, a species of vegetation of the mucous membrane. The disease is occasionally noticed in early life, but is most common in middle-aged and elderly subjects. Males are most liable to it. It is generally insidious in its origin, and nothing is known respecting the nature of its exciting causes. The growth varies in its size from that of a pea to that of a pullet's egg, and is of a soft, spongy consistence, with a rough, fimbriated, or villous surface. In some instances, as in the specimen from which the annexed drawing was taken, it occurs in considerable numbers, so as to stud the greater part of the surface of the bladder. Its form is generally globular, ovoidal, or pediculated, and its color is commonly a few shades redder than that

¹ *Medicin. National Zeitung für Mai*, 1798.

² *Prolusio, de Ischuria ex tumoribus Vesicæ*. Lips. 1767.

³ *Richter's Chirurg. Biblioth.* Band V. S. 564.

of the mucous membrane upon which it rests, and from which it arises. Examined with the knife, the tumor is found to consist of

Fig. 57.



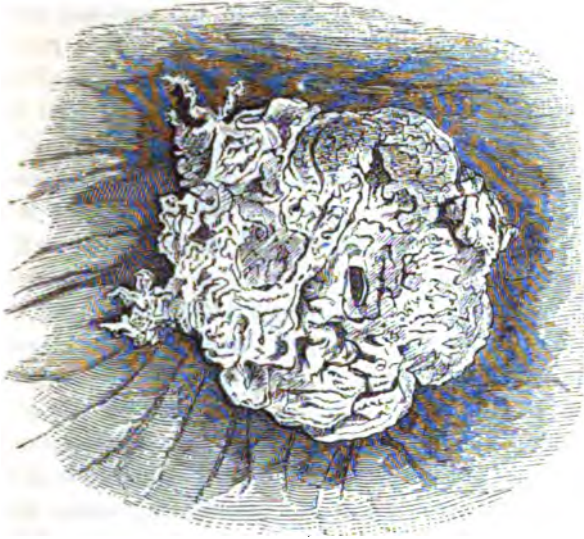
Fungous tumors of the bladder, copied from Civiale. The walls of the bladder are much thickened; and the inner surface of the viscus is studded with numerous excrescences, the surface of which has a singularly fimbriated appearance. The prostate is much increased in volume, and the middle lobe forms a nipple like process which projects backwards into the bladder. The urethral crest is much enlarged.

a grayish, cellulo-fibrous tissue, covered by a prolongation of the lining membrane. Small vessels enter it in different directions, and are liable, when ruptured, to pour out a considerable quantity of blood. The surface of the morbid growth is often incrustated with calculous matter, and, in the few instances in which I have met with it, it was associated with stone in the bladder. The only evidence of the existence of this disease is the presence in the urine of a portion of the abnormal substance. All other symptoms are fallacious.

Tumors of an erectile, vascular character, similar to that of an anastomotic aneurism, or a maternal nævus, sometimes occur in this organ. The annexed drawing (Fig. 58), taken from a preparation in the pathological collection of the New York Hospital, represents a growth of this description. The specimen was deposited by Dr. Cheeseman, one of the surgeons of that institution, to whose politeness I am indebted for the following history of the case. The patient was a widow, seventy-two years of age, of a spare habit of body, and the mother of five or six children. Though naturally feeble, her

general health was always good until about three years before her death, when she began to complain of uneasiness in her bladder,

Fig. 58.



attended with a frequent inclination to void her urine, which was always mixed with blood. Her symptoms gradually increased in violence; she became pale and anemic, and finally died completely exhausted. For some time before her death, she suffered severely from pain in the bladder during micturition, especially immediately after the passage of the last drops of water. She never experienced any retention, and the blood always came away in a dissolved condition. Upon examining the bladder after death, a tumor was found upon its floor, of a soft, spongy character, of a florid color, circular in its form, and about two inches in diameter. It seemed to spring from the mucous membrane, and had a rough, irregular surface not unlike that of a cauliflower. The parts around were free from inflammation and other disease; but the muscular tunic was somewhat thickened and reticulated. All the other organs were healthy.

Of the exciting causes and diagnostic characters of polypus, fungous, steatomatous, and other tumors of the bladder, nothing, unfortunately, is known. From the constant pains in the pelvic region, with the straining efforts, and the frequent inclination to void the urine, which are almost always present, the existence of

stone is apt to be suspected; an apprehension which is not always relieved by sounding, which, however, should never be omitted in cases of a doubtful nature.

Whenever, in any manner, their real character can be ascertained, the bladder should be laid open as in the common operation of cystotomy, and the morbid growths removed with a pair of probe-pointed scissors curved on the flat. From their want of vascularity, it is not probable that much hemorrhage would attend this procedure, and if the subsequent inflammation, which would no doubt generally be considerable, could be combated, the patient would be perfectly safe, the more especially as the disease is rarely, if ever, of a malignant character, and consequently not liable to reproduction.

In 1834, Mons. Civiale communicated to the Academy of Sciences of Paris, the particulars of several cases of fungous tumors of the bladder, in which he appears to have succeeded in effecting a complete cure by means of torsion and crushing. The apparatus employed for this purpose was of peculiar construction, and the operation consisted in separating the morbid growth from its attachments, and then breaking it into small fragments, which were afterwards discharged along with the urine. In one of the patients thus treated, considerable blood was lost, and in another the operation was followed by high inflammation. They both, however, completely recovered. Where the diagnosis can be clearly determined, such a mode of procedure might not be improper; but in all doubtful cases, and especially when the tumor is of a vascular character, I should be very loath to resort to it. Le Cat, long ago, recommended cutting forceps for removing fungous tumors of the bladder.¹

No internal remedies, so far as is known to us, exert the slightest influence in arresting these tumors, or in modifying their growth and development. Hence, all that the practitioner can do, where the disease cannot be reached by operation, is to endeavor to palliate the patient's suffering, by anodynes, and such other means as his actual condition may, from time to time, seem to require.

¹ Philos. Transact. of London, vol. xlvii. p. 29.

CHAPTER VIII.

WORMS IN THE BLADDER.

It seems almost incredible, when we reflect upon the irritating nature of the urine, that the bladder should ever be the residence of worms. Such, nevertheless, is the fact, and the probability is that the occurrence is much more frequent than is generally supposed. Many instances of the kind, bearing all the intrinsic evidence of authenticity, are recorded by the old writers, as Rhodius, Bonetus, Bartholin, Tulpius, Barry, Henkel, and Acrel; and by Lawrence, Curling, Brigham, Campbell, and others, among the moderns.

The worms are either of a distinct and specific character, such as are found in no other situation, or they creep into the bladder from the rectum, the colon, or the small intestine. In nearly all the recorded instances of the latter, the animal was of the lumbricoid or ascaridic variety, which left its accustomed habitation, and migrated into the urinary reservoir, either by perforating the coats of the alimentary canal, or, as more frequently happened, through an ulcer produced by the irritation of an abscess, a piece of bone, or some other extraneous body.

Of the worms which naturally inhabit the urinary bladder, only two species have hitherto been discovered; the one by Mr. William Lawrence, the other by Mr. T. B. Curling, of London. The animal described¹ by the first of these distinguished surgeons, is the *spiroptera*, of which, in the space of about two years, a young unmarried woman, twenty-four years of age, voided not less than from eight hundred to a thousand. They varied in length from four to six inches, and were remarkably slender at the middle, from which they gradually increased towards the extremities, which were small and tapering. One of the surfaces of the body exhibited the appearance of a double row of small protuberances, while the other was marked by a groove with two rising edges. They were soft when first voided, and of a yellowish color. The body seemed homogeneous throughout, and

¹ *Medico-Chir. Transactions of London*, vol. ii. p. 386.

careful microscopical observation failed to throw any light upon its organization. The smaller worms, which were seen only on one occasion, were semi-transparent, and of a rounded form, with pointed extremities. I am not acquainted with any instances in which this worm has been noticed in the human subject by other observers.

The worm discovered by Mr. Curling¹ has been named by him *dactylius aculeatus*, from its peculiar ring-like appearance. It was voided with the urine, for a number of days, by a little girl five years of age, who was affected with subacute pneumonitis, and who was also occasionally troubled with ascarides. The worm is of a light color, cylindrical in its form, annulated, and slightly tapering towards the extremities, particularly the anterior, which is the smaller. The female (Fig. 59) is four-fifths of an

Fig. 59. Fig. 60.



inch long, the male (Fig. 60) two-fifths. The head is truncated; the mouth orbicular; the neck distinctly annulated; and the tail, also annulated, is obtuse. The tegument, of a delicate transparent structure, and containing two layers of muscular fibres, one circular, and the other longitudinal, is armed with a

number of sharp-pointed spines, arranged in equidistant rows, in clusters of three, four, or even five. They cover nearly the whole surface, and seem to be perfectly under the control of the animal, which has the power of protruding and retracting them at pleasure. The alimentary canal commences at the mouth by three small convoluted tubes, which soon unite into a single one, which proceeds for some distance in a tortuous direction, when it becomes sacculated, and enlarging as it descends, terminates at the extremity of the tail in a trilobular anus.

The structure of the female is much more complicated than that of the male. The vulva is situated near the anterior extremity, about one-fifth of an inch from the head, and has the appearance of an opaque, mammillated process. The animal swells at this part, the tegument is thicker, there are no spines, and, for a short distance above and below the vulva, the body is encircled by a series of regular dark-colored fibres. About midway between the head and vulva, and on opposite sides of the alimentary canal, are two granular bodies, of an oval form, and just below these, two slightly convoluted tubular processes. No genital apparatus was discernible in the male. Both sexes have a distinct vascular, and, doubtless

¹ Medico-Chir. Transactions of London, vol. xxii. p. 274.

Fig. 61.

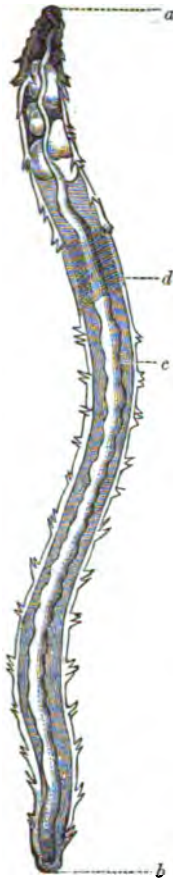


Fig. 62.

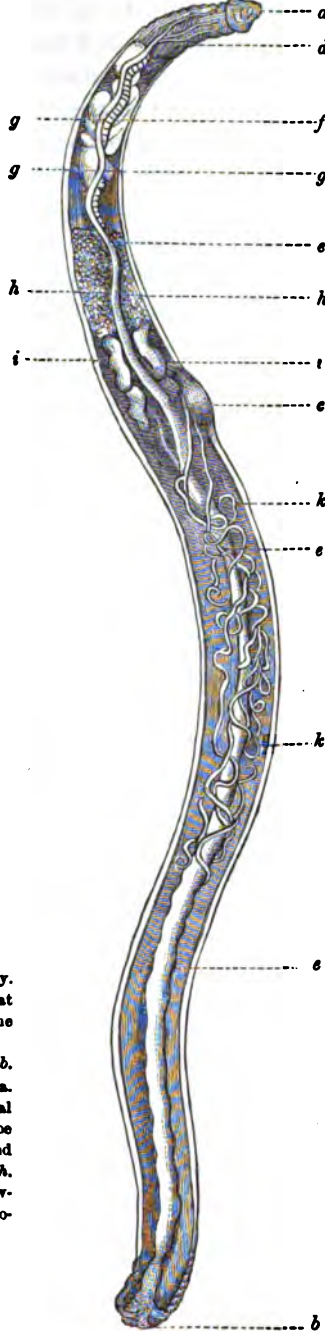


Fig. 61.—*a*. The head. *b*. The caudal extremity. *c*. Sacculated alimentary canal. *d*. Dark lines at the junction of the anterior and middle third of the animal.

Fig. 62.—*a*. Head, with the orbicular mouth. *b*. Caudal extremity, with the labiated anus. *c*. Vulva. *d*. The three tubes by which the alimentary canal commences. *e*. Alimentary canal. *f*. Pulsating tube in the alimentary canal. *g*. Lobulated bodies round the commencement of the alimentary canal. *h*. Glandular bodies on the sides of the canal. *i*. Movable finbristled bodies near the vulva. *k*. Convoluted oviducts.

also, a nervous system. The wood-cuts on the opposite page represent the internal structure of the worm. Fig. 61 is the male, Fig. 62 the female, both magnified ten times.

In the interesting cases related by Dr. Campbell,¹ of Connecticut, a man, sixty-five years of age, passed, in the space of three weeks, thirty small red-headed worms, not more than half an inch long. Their bodies were made up of a great many minute cartilaginous rings, and were furnished with a number of legs, arranged in two distinct rows, extending from one extremity to the other. They were hard, very active, strong, and remarkably tenacious of life. Two of them, inclosed in a quill, and carried in the pocket, were, at the end of four weeks, as lively and vigorous as at the moment when they left the bladder. It is to be regretted that Dr. Campbell could not determine the species to which these worms belonged.

I have never met with a case of worms in the bladder; but last summer, a man named Sandy, a farmer, aged about thirty-five, who was said to have passed some repeatedly, was sent to me by my friend Dr. Hester, of Gosport, Indiana, on account of chronic disease of the digestive and urinary organs, attended with neuralgic pains in different parts of the body. They were of a regularly cylindrical shape, slightly tapering towards the tail, being about five-eighths of an inch in length and of the thickness of a coarse sewing thread. The head was somewhat protuberant and not unlike that of an eel. They were alive, and of a white color immediately after being voided, swimming about for a few minutes, when they became motionless, and assumed a dark muddy appearance. The number of worms passed at a time varied, but on several occasions at least half a dozen came away. The use of turpentine, which the man took several times daily, in doses of from fifteen to twenty drops, seemed to have promoted their expulsion. The urine, while he was under my care, was unnaturally acid and mucous, but never contained any entozoa. The probability is that they belonged to the species first described by Mr. Curling.

A case in which many thousand worms were passed from the bladder, in the space of a few months, was reported, in 1834, by Dr. Bardwell, of Indiana, in the seventh volume of the *Western Journal of the Medical and Physical Sciences*, edited by the late Professor Drake. The patient, a man, aged thirty, had been subject from his earliest infancy to attacks of intermittent fever, and for

¹ Amer. Journ. Med. Sciences, vol. xxi. p. 180.

some years past he had suffered under severe pain in the bladder and difficulty in urinating, attended with all the usual symptoms of stone. His digestive organs had become greatly deranged, and his general health had much declined. Various plans of treatment had been pursued, without any material advantage, until one day, while laboring under the effects of a large dose of castor oil and spirits of turpentine, he voided upwards of seventy lumbricoid worms. Before the effects of the medicines had passed off, numerous worms were discharged by the urethra, accompanied by bloody urine, and great distress in the passage. They were from six to nine lines in length, and about the thickness of a horsehair, with a black and rather large head, their color being of a dark, dirty-white. They possessed considerable activity, could crawl about on the ground or on the floor, and many of them lived twenty-four hours after they had been voided. They continued to be discharged for more than six months, many thousands coming away during this period; the urinary disease gradually subsided, the general health rapidly improved, and eventually the man entirely recovered. The use of turpentine, which was kept up for some time, seemed to have been of the greatest benefit in this case, which may be considered as one of the most remarkable of the kind on record.

Of the *causes* of vesical worms nothing whatever is known. The number of recorded cases is too few, and the facts connected with them have been too imperfectly noted, to justify us in drawing any conclusions from them in regard to the etiology of these singular beings.

The *symptoms* of worms in the bladder are exceedingly equivocal. In general, they are such as attend stone. The patient is harassed with pain, frequent and difficult micturition, spasm and sudden stoppage of the flow of urine, followed ultimately by fever, derangement of the digestive organs, and gradual emaciation. Sometimes there is paralysis of the bladder, the contents of which are obliged to be evacuated from time to time with the catheter. If the sound be used, and it comes in contact with the foreign body, the sensation is imparted to the hand of a soft mass or tumor, which fails to emit the sharp noise, or click, peculiar to calculus. The urine, especially in protracted cases, is frequently loaded with mucus, and sometimes tinged with blood. The only diagnostic sign is the appearance of the worm itself.

In the case described by Mr. Lawrence, the patient, a female twenty-four years of age, was seized, in the winter of 1806, with

retention of urine, requiring the daily use of the catheter. She complained of great weight in the bladder, pain about the loins, and numbness of the thighs. She seldom passed any water, and then only a few drops, much tinged with blood. By 1809, she was much emaciated; her tongue had often a typhoid appearance; she had no appetite; there was pain in the lumbar and vesical regions; and for six months she had voided no urine, except with the aid of the instrument. About this time she was seized with violent fits whenever the water was retained longer than usual, or whenever the pain and burning heat in the bladder were particularly great. Sounding increased the local distress, and produced in the patient a sensation as if the instrument had struck against a ball at the top of the organ. From this period the feeling of weight gradually augmented, and she experienced an internal fluttering, as if something was moving. The quantity of urine gradually diminished; the fluttering became more violent, and so strong as to be perceptible to the hand; and the bladder, which was much enlarged, even when entirely empty, was so tender that the weight of the bedclothes could not be borne. Worms now began to pass, affording, for the first time, a clue to the nature of the disease.

No symptoms of derangement of the urinary organs existed in the case of Mr. Curling. The discovery of the worms was altogether accidental. In the case reported by Dr. Campbell, the patient had been affected for several years with occasional interruptions of the flow of urine, which went on gradually increasing until it amounted to complete retention. There was, moreover, irritation at the neck of the bladder, accompanied with pain, and a frequent desire to make water. In the case mentioned by Dr. Brigham,¹ of Connecticut, in which a married woman, thirty-five years old, passed a white round worm, about six inches long, the symptoms so closely resembled those of stone that the sound was repeatedly used, and he was sent for to perform the operation of lithotomy.

From the situation of the bladder, it is evident that any worms infesting it must be beyond the reach of medicines administered by the mouth. It does not appear, that, in the cases observed by Lawrence, Curling, and others, any benefit whatever resulted from the use of anthelmintics: such, for example, as the oil of turpentine, and the balsam of copaiba, which, it is well known, has a specific tendency to the urinary organs. The best mode of proceeding is to

¹ Amer. Jour. Med. Sciences, vol. xx. p. 59.

employ stimulating injections, three or four times a day, for the purpose of making a direct impression upon the worms. Of the various articles that suggest themselves, the most likely to effect the object are a solution of vinegar, creasote, aloes, chenopodium, spirits of turpentine, and garlic. These, if properly diluted, may be thrown into the bladder without injury to its lining membrane, and with a reasonable prospect of proving destructive to its inmates. To derive full benefit from their administration, the urine should, in all cases, be previously evacuated, that the fluid may be brought into more immediate contact with the entozoa. The frequent introduction of the catheter has, in repeated instances, been attended with good results. By pressing the point of the instrument against an animal of this kind, it might be squeezed to death, and even be entangled in its eyelets. Dr. Artaud, a French surgeon, succeeded, in one instance, in removing, by means of Hunter's forceps, a number of worms and fleshy substances from the bladder of an unmarried woman of twenty-six.

CHAPTER IX.

SEROUS CYSTS AND HYDATIDS.

SEROUS cysts have sometimes been discharged from the urethra, and found after death floating loose in the bladder. The probability is that they are seldom, if ever, developed in this organ, but that they pass into it from the kidney, along the ureter, or from the pelvic cavity through an artificial opening. They have been observed in both sexes, and at different periods of life. Varying in size between a millet-seed and a pigeon's egg, they are of a globular figure, white, transparent, and filled with a thin, watery fluid. Their presence is productive of pain and spasm of the bladder, with frequent micturition and sudden stoppage of the flow of urine, sometimes followed by total obstruction.

The occasional existence of *acephalocysts* in the bladder is well known. Though generally very small, they sometimes attain the volume of a pullet's egg; they are of a globular or ovoidal shape, and exhibit the same structure as in other parts of the body. Like

the serous cysts just described, they produce no characteristic symptoms, and are probably always developed originally in the kidneys, or in the cavity of the pelvis.

CHAPTER X.

FŒTAL REMAINS IN THE BLADDER.

THE remains of a fœtus have sometimes been found in the bladder; but the occurrence is extremely rare, and is hardly of any practical interest. Occasionally only a single bone is met with, as in the instance mentioned by Sir Benjamin C. Brodie, where there was merely a jaw, with full-grown teeth. Most commonly, the osseous fragments exist in considerable numbers, and are intermixed with soft substance and calcareous concretions. In all cases of this kind, the fœtus is originally developed in the abdominal cavity, the ovary, or the Fallopian tube, from which it gradually makes its way into the urinary reservoir, in consequence of ulcerative action produced by its own presence. The resulting symptoms resemble those of stone in the bladder; but the diagnosis must necessarily be obscure, unless there is a discharge of bony fragments, teeth, hair, or other débris of the included fœtus. When the quantity of retained matter is considerable, it may form a tumor, which will be hard to the touch, and readily distinguishable through the walls of the abdomen, the vagina, and the rectum. It may also be detected with the sound.

The most remarkable example, perhaps, of this occurrence upon record, is that mentioned by Dr. Josephi,¹ of Rostock. I subjoin the following abstract of it in illustration of its symptoms and progress. A woman, in the thirty-seventh week of her second pregnancy, was seized with violent pains in the abdomen, which were followed by paralysis of the right leg, on recovering from which, a few weeks after, she no longer perceived the movements of her child. Her breasts, however, were filled with milk. Towards the fifteenth month, a discharge of putrid blood took place from the vagina. A month after this her menses returned, and she enjoyed

¹ London Medical and Physical Journal, vol. xiv. p. 519.

pretty good health, except that she had frequent pains in the bowels, and a sense of pressure in the bladder. At the end of nine years, she began to suffer from ischuria, attended with violent spasms in the pelvis, and a constant inclination to pass water, which was very scanty, of a whitish, purulent character, and often mixed with thick, jelly-like lumps. Three years after this, she observed a hard body in the urethra, followed by degrees by a discharge of ninety-four calculi, a number of cranial bones, some vertebræ, six teeth, a tibia, a part of a fibula, and twenty-one flat pieces. Twenty months subsequently, and when the woman was forty-seven years of age, Dr. Josephi found her bladder much distended, and easily distinguishable by the touch. The supra-pubic operation was now performed, and the whole organ was discovered to be filled with a hard mass, intermixed with soft substance. One hundred and twenty pieces of bone, partly entire and partly eroded, were extracted; besides twenty calcareous concretions, some cartilages, a portion of the skull and face, and the bowels, which were of a dark blue color.

The operation ended fatally in three days. The bladder was of a thin, spongy texture, and at many parts cartilaginous. Its inner surface was studded with a great many soft excrescences. At the upper part of the organ was a hole, about the size of a sixpence, with hard, callous edges. Towards the right side was a considerable bag, adhering to the bladder, and containing a portion of the bowel. Opposite to this, on the left side, was another opening, about two inches and a half in diameter. Through this opening the bowel protruded into the bladder, along with a fold of the peritoneum, which formed a separate sac, the surface of which was smooth, and covered with purulent matter. The right ovary and part of the right Fallopian tube were destroyed. The uterus and other viscera were sound.

Another case, well worthy of notice, and very similar to the one just mentioned, occurred in 1816, in the practice of Dr. Joseph Boesuet,¹ of Hingham, Massachusetts. The patient, whose age is not mentioned, after having passed through the ordinary sufferings of pregnancy, was seized, late in the spring of 1808, with all the symptoms of true labor. In a fortnight, the pain had completely subsided, and for the next two months, she experienced merely a disagreeable dragging sensation. The abdomen swelled to a very large size; but this, after some time, gradually diminished; and the

¹ *New England Journal of Medicine and Surgery*, vol. vi. p. 184. 1817.

three succeeding years were passed without much distress. At the expiration of this period, however, she began to suffer from acute pains, attended by a profuse discharge from the urethra, of very fetid matter, sometimes mixed with blood, and sometimes with very small bones. A communication also took place between the bladder and the rectum, allowing the urine and feces to pass either way. During the five years immediately preceding Dr. Bossuet's attendance, the woman experienced the most excruciating pain, both day and night. On examining the bladder, it was found that it contained a child, incrustated with earthy matter. The operation of lithotomy was performed on the 17th of June, 1816, when one hundred and forty-six foetal bones were extracted, along with a calculus about the size of an olive. The woman gradually recovered; but when the case was reported, in March, 1817, the communication between the bladder and the rectum had not entirely closed.

CHAPTER XI.

HAIR IN THE BLADDER.

A NUMBER of examples in which this phenomenon was observed, are recorded by authors. The publications, however, which, so far as I know, contain the most ample information on the subject, are Voigtel's *Handbuch der Pathologischen Anatomie*, and Delpech's *Chirurgie Clinique*. In the first of these productions are references to nearly all the cases of the kind which have been recorded up to the time of its appearance early in the present century. The affection is more common in women than in men, in the former of whom it is frequently associated with disease of the uterus, ovary, or Fallopian tube, and is probably nearly always the product of a false conception. What corroborates this view is that, in many cases, the bladder and uterus are closely adherent, and communicate together by a distinct opening; moreover, the foreign substance is occasionally found in company with foetal remains, as a bone, cartilage, or tooth. The hair may be loose in the bladder, or it may be encysted or inclosed in a membranous sac. When it exists in considerable quantity, it gives rise to severe pain, irritability of the bladder, and all the ordinary symptoms of stone. A discharge of

hair has been known to continue, with various interruptions, for several years. Tulpius relates an instance in which it was voided regularly every fortnight. It generally passes off in small pellets, surrounded by mucous and earthy matter. In the male, it usually occurs in connection with stone, to the surface of which it sometimes firmly adheres. The hair is occasionally closely matted, and of great length.

In the very interesting and instructive case recorded by Delpech,¹ large quantities of hair, mixed with calculous matter, were from time to time extracted from the bladder through the urethra. The disease caused severe pain in making water, and other symptoms of stone. Having obtained all the information he could respecting the nature of the complaint, by repeated soundings and manual explorations, he divided the meatus with the lithôtome caché towards the pubic symphysis, and extracted a small calculus, together with a large mass of hair and earthy matter, which had been contained in a cyst in the back part of the bladder, where this organ was united to the uterus. A portion of the cyst itself was subsequently removed, partly by ligature, and partly by injections, passed through a pipe into its cavity from a height of six feet. The woman finally recovered, after the discharge of an additional quantity of hair and calculous matter, and a substance as large as a hen's egg, which was covered by scalp, and contained a molar tooth.

CHAPTER XII.

AIR IN THE BLADDER.

CASES are occasionally observed in which the bladder contains air, although in every respect organically sound. The phenomenon has been chiefly witnessed in connection with paralysis of the bladder, consequent upon over-distension, injury of the spine, or disease of the brain. The urine is generally natural, both as it respects its color, quantity, specific gravity, and chemical reaction. The air, the precise character of which is unknown, either issues in the form of bubbles, or passes off with a gurgling noise; the latter is especially apt to occur when a catheter is used. In some instances, the organ

¹ *Chirurgie Clinique*, t. ii. p. 521.

has been found nearly filled with gas. It is not easy to determine how the air is formed in these cases, whether it is secreted by the mucous coat of the bladder, or whether it is the result of decomposition of the urine. It is not unlikely that the former is the more correct explanation of the two; at all events, the conjecture, for it amounts to nothing more, derives support from the fact that the viscus is generally in a state of paralysis, and therefore incapable of performing its functions in a healthy or satisfactory manner. In great torpor of the bowels, gaseous distension is of frequent occurrence, and probably arises from this cause.

CHAPTER XIII.

VARIX OF THE BLADDER.

NEARLY all the veins of the body are liable to enlargement from disease of their walls and the habitual distension of their cavities. The affection is most common in the veins of the inferior extremities, but it also occurs in other parts, as in the veins of the face, lips, oesophagus, eyelids, the vulva, vagina, and the recto-anal outlet, in the latter of which it constitutes what are called hemorrhoids. A similar enlargement occasionally takes place in the veins of the neck of the bladder, where it is capable of playing a most important part not only in the maladies of this organ, but also in some of the operations required for their relief. In lithotomy, for example, the division of some of these vessels, which are often greatly dilated in urinary calculi of large size and of long standing, is occasionally followed by copious and even fatal hemorrhage; a circumstance of which every operator should be fully apprised, so that, should such an accident arise, he may not be at a loss to apply the proper remedies.

The vesical veins are quite numerous, and form, as is well known, a large plexus around the neck, sides, and base of the bladder, as well as around the prostate gland. Hence, the term vesico-prostatic has sometimes been applied to them. Their arrangement is very complicated, and after having freely interlaced with each other, they eventually terminate in the internal iliac veins. They are embedded in a large quantity of cellulo-fibrous substance, receive the super-

ficial veins of the penis, and communicate, behind, with the hemorrhoidal plexus.

Varix of the bladder is not a disease of recent discovery; on the contrary, it has been known almost from time immemorial. By some of the older writers it was described under the term hemorrhoids, in reference to the resemblance, real or fancied, which it occasionally bears to hemorrhoids of the anus and rectum. It is rare, however, that the disease is so well defined as to entitle it to such an appellation. In the seventeenth and eighteenth centuries, the affection received the special attention of Bonetus and Morgagni, who have each left some well-marked examples of it.

Although the affection under consideration occurs most commonly in old age, it is sometimes observed at a comparatively early period, especially in persons who have been long afflicted with stone in the bladder, stricture of the urethra, hypertrophy of the prostate gland, or organic disease of the anus and rectum. The enlargement may be circumscribed or diffused, according to the number of vessels implicated in the disease, and it may present itself in various degrees, from the slightest increase in the size of the affected vessels to the most remarkable dilatation. In the more confirmed forms, the veins are not only much augmented in volume, but they have a tortuous, convoluted arrangement, similar to what occurs in varix of the leg and thigh. When thus affected, their walls are always more or less thickened from interstitial deposits, and their cavities are occupied by fibrinous concretions and even by phlebolites. The connecting cellulo-fibrous tissue through which the enlarged vessels are ramified is also materially increased, forming not unfrequently a thick, dense mass, divisible, especially along the *bas-fond* of the bladder, into a number of layers. While these changes are going on upon the exterior of the organ, a similar but less conspicuous enlargement occasionally takes place within at the neck and most dependent portion of the body of the viscus. The disease here consists either in a simple varicosity, or in the development of a vascular growth, not unlike hemorrhoidal tumors, both in their structure, color, and consistence. Such tumors, however, are uncommon; they seldom exceed the volume of a small filbert, and are usually situated near the neck of the bladder. In general, they are associated with other diseases, particularly stone, which, no doubt, often acts as an exciting cause.

The phlebolites accompanying this disease occasionally exist at an early period of life. A few years ago, I examined a black man,

aged-twenty-seven, dead of pleuro-pneumonia, in whom there were six concretions of this kind, situated in the right vesical veins, and varying in size from the head of a large pin to that of a hempseed. They were of a rounded figure and of a dark grayish color; the veins in which they were contained were much enlarged, and filled with fibrinous matter. The bladder itself was entirely free from disease. The chemical composition of these bodies is phosphate and carbonate of lime, in union with animal matter. Their mode of formation will be pointed out in the division of the work which treats of the diseases of the prostate gland.

The influence of mechanical obstruction in causing varix of the bladder is rendered very apparent by the fact that the disease is almost invariably associated with stone in the bladder, obstruction to the evacuation of the urine, and organic affections of the anus and rectum. The current of the blood being thus habitually interrupted, the distended vessels become gradually dilated and tortuous, as well as seriously changed in their structure from the effects of chronic inflammation, the inseparable concomitant of such a condition.

There are, unfortunately, no symptoms by which this disease can be distinguished from other affections. Its existence must always be a matter of inference rather than of positive demonstration. A person may be supposed to be laboring under it when, if he has stone in the bladder, stricture of the urethra, or hypertrophy of the prostate gland, he has frequent attacks of hemorrhage, venous in its character, not profuse, and attended with a sense of weight low down in the pelvic region. The enlarged vessels, under such circumstances, sometimes give way, especially during straining and the introduction of instruments, though the bleeding is seldom either profuse or protracted. Bonetus¹ describes a case where a disease of this kind simulated stone in the bladder. The patient at length died, when no calculus was discovered, but the veins around the neck of the organ were varicose and very much distended with blood. In the chapter on hemorrhage of the bladder will be found the particulars of a case, observed by Professor Laugier,² of Paris, in which the bleeding was so abundant as to prove fatal.

When the existence of varices is suspected, relief should be attempted, first, by the removal of the exciting causes of the disease, and secondly, by the application of leeches to the perineo-anal

¹ Sepulchrum, lib. iii. sect. xxv. p. 263.

² Gazette des Hôpitaux Civils et Militaires, Juillet 8, 1854.

region, the cold douche, the frequent injection of cold water into the rectum, and the use of mild laxatives, with rest in the recumbent posture. All heating and drastic cathartics must be avoided, on account of their tendency to stimulate the lower bowel, and thus invite a determination of blood to the affected parts. For the same reason diuretics should be interdicted, especially the different preparations of cantharides. The manner in which the hemorrhage, consequent upon a division of these vessels, is to be arrested, will be pointed out under the head of lithotomy.

The hemorrhage which occasionally attends this affection should be controlled, if possible, by the exhibition of gallic acid, acetate of lead, creasote, and other appropriate remedies; aided with injections of cold water into the rectum, and the application of ice to the perineum and hypogastrium.

CHAPTER XIV.

HEMORRHAGE OF THE BLADDER.

A DISCHARGE of blood from the bladder, technically denominated hematuria, although not of frequent occurrence, is generally a source of disquietude to the patient, from a belief, not altogether unfounded, that it is a symptom of evil import. The subject is one, however, apart from any consideration of this kind, of sufficient importance to merit attention in a monograph on the diseases of the urinary passages. This is the more necessary, because of the reserve, if not actual silence, with which it is treated in most of our systematic works on surgery.

Hemorrhage of the bladder occurs in both sexes, and at all periods of life. Men, however, are more prone to it than women; and it is likewise more common in old and middle-aged subjects than in children and adolescents. A sort of endemic tendency to this form of hemorrhage has sometimes been noticed, but the circumstance is extremely rare, and I have never witnessed it. What influence, if any, climate, season, and habit exert upon the production of this affection, we have no facts to determine. The hemorrhage is of such infrequency, comparatively speaking, that it would be a difficult matter to clear up this subject.

Causes.—Vesical hemorrhage presents itself under two varieties of form, the idiopathic and the traumatic. The idiopathic variety is infrequent, and is met with chiefly in elderly persons, of a weak, lax habit of body, or in such as are affected with scurvy or an anemic condition of the system. It sometimes occurs in association with, or as a consequence of, rubeola, smallpox, plague, and typhoid fever.

The traumatic form of hemorrhage is usually the result of a wound of the bladder, such, for instance, as is made in the operation of lithotomy; or of the rude or forcible use of instruments, as the lithontriptor, the bougie, sound, or catheter. The bleeding, under such circumstances, may proceed either from one tolerably large vessel, or from a considerable number of small ones, and in either case, it may be small and insignificant, or so profuse as to endanger life.

Persons affected with stone are very liable to suffer from hemorrhage of the bladder, especially after rough exercise, whether conducted on foot, in a carriage, or on horseback. Some years ago I had a calculous patient, twenty-three years of age, who experienced frequent attacks of this kind from the most trivial exertions, in many of which he lost from two to three ounces of blood. Worms, accidentally lodged in the bladder, or developed there, have been known to cause profuse and even fatal hemorrhage. Violent concussion of the body, as from a fall or counter-blow, severe exercise on horseback, and venereal excesses, may be enumerated as among the more common causes of this affection.

A very remarkable case of hemorrhage of the bladder, caused by the presence of worms in that organ, has been described by Dr. J. M. Waddy, in the *London Lancet* for 1843. The patient was a poor woman, sixty years old, who was laboring under chronic disease of the liver, and who had long suffered from violent attacks of bleeding, which gradually exhausted her strength, and ultimately destroyed her life. The urine usually contained a considerable quantity of blood, but occasionally it was perfectly clear and natural. Upon inquiry, it appeared that she had, at various periods, voided worms, some of them nearly a foot in length, and about the diameter of a goosequill, with a long and extremely sharp-pointed tail, exactly resembling one of the rat-tailed larvæ, but in a state of great enlargement; some being alive, others dead at the time of their expulsion. No explanation is offered, by the reporter of the case, as to the manner in which the worms gained admission, whether

they were introduced from without or generated within the urinary apparatus; but the fact that they were discharged from that organ, was satisfactorily established. The only local remedies used were oil and lime-water, in the form of injections; which seemed to be very destructive to these singular residents. No examination was made after death, and consequently the precise condition of the urinary apparatus could not be ascertained.

Varices of the bladder occasionally give rise to hemorrhage; sometimes slight, at other times copious; now of short duration, now long-continued. An instance recently occurred at the Hôtel-Dieu in Paris, in the service of Professor Laugier,¹ in which the bleeding was so profuse as to prove fatal. The patient, who had some time previously labored under acute myelitis, with paraplegia, had been in the house several days, on account of a bony tumor, when the attack came on. The blood was of a dark color, and was voided perfectly pure, without any admixture of urine. Catheterism failed to detect any appreciable lesion in the bladder, which was much distended, and pushed high up into the abdomen. The hemorrhage continued to recur at intervals, sometimes slightly, at other times copiously, until the man sunk from exhaustion. The autopsy revealed the existence of several large varices at the neck of the bladder, upon one of which was a large ulcer, from which the bleeding had evidently proceeded. The organ was perfectly sound in other respects.

A considerable hemorrhage of the bladder occasionally results from the use of drastic cathartics and irritating diuretics, especially cantharides and spirits of turpentine. Ulceration of the mucous and sub-mucous cellular tissues of the organ is nearly always accompanied by bleeding, and one of the most characteristic signs of fungous, encephaloid, and erectile tumors, is a considerable discharge of blood. In a case of the latter growth, to which allusion has been already made, the hemorrhage was so constant and profuse as to end fatally. Finally, vesical hemorrhage is sometimes vicarious of the menstrual flux and suppressed hemorrhoidal discharges. It has also, though rarely, marked the crisis of other diseases.

Pathology.—The pathology of this affection is thus perceived to vary according to the nature of the exciting cause. In the traumatic form, for instance, the bleeding is produced by direct injury of the vessels, and the same is probably true when it accompanies ulceration and the presence of a stone. In the latter case, the fric-

¹ Gazette des Hôpitaux Civils et Militaires, No. 81, Samedi, 8 Juillet, 1854, p. 321.

tion of the concretion, especially when it is rough, against the surface of the bladder, is sufficient to lacerate the delicate vessels of the mucous membrane, and to produce frequently a smart discharge of blood. In the idiopathic form, the probability is that the bleeding is the result of a process of exhalation, or, more philosophically speaking, of secretion. The hemorrhage which accompanies the presence of erectile, fungous, and other tumors, is caused, in most cases, by rupture of the bloodvessels, from over-distension of their coats, which are generally, in these formations, in a weakened and fragile condition, and therefore prone to give way under the slightest causes.

Quantity and Character.—The quantity of blood varies in different cases, and under different circumstances, from a few drachms to several pounds. In the traumatic variety the flow may be so copious as to prove fatal in a few hours, if not, indeed, much sooner. Persons who are cut for stone, or whose bladders are wounded accidentally, not unfrequently lose their lives in this manner. A copious hemorrhage may also result, as was previously intimated, from ulceration of the bladder, and from the presence of morbid growths. In these cases, however, life is usually destroyed gradually, not suddenly, as it sometimes is when the bleeding is of a traumatic nature. A violent hemorrhage occasionally follows upon severe bodily exertion, as in the instance recorded by Van Swieten,¹ of a riding-master, who, soon after an attempt to break a stubborn horse, discharged not less than eight pounds of blood in a few hours. After recovering from the attack, he remained well for several years, when he had a return of the bleeding, more copious and protracted than the first, from the effects of which he never recovered. Great debility ensued, and he finally died dropsical.

The blood varies likewise in its color and consistence. When recently effused into the empty bladder, it is of the natural appearance; but if it has been retained for some time, or been mixed with the urine, it assumes a dark-brownish, turbid, or muddy hue, not unlike port wine, or the water used for washing flesh, or bleeding in the foot. In some instances, especially when it is pent up for a long time, it is of the color of tar or molasses. In its consistence, the blood may be liquid, semi-fluid, or completely coagulated. The former condition generally obtains when the effusion is recent, the second, when it is of several hours' standing. Full coagulation

¹ Comment in Aph. Pat. 1422, p. 251.

seldom takes place, except in the traumatic form of the affection, in connection with an empty, or partially empty bladder. These changes in the color and consistence of the effused blood are owing to the chemical action of the urine, and hence they will generally be slight or well marked, according to the quantity and quality of the fluid present.

Symptoms.—The most important, because the most characteristic symptom of vesical hemorrhage, is a discharge of blood from the urethra, either alone or in combination with the urine, and accompanied, if the quantity be at all considerable, by a frequent desire to micturate, spasm at the neck of the bladder, and a burning sensation along the course of the urethra. When the blood coagulates nearly as fast as it is poured out by the bladder, it may lead to retention of urine, either partial or complete, temporary or permanent. Copious effusions of this kind may be followed, sooner or later, by all the symptoms of exhaustion, such as nausea, faintness, pallor of the countenance, feebleness of the pulse, sighing, restlessness, coldness of the extremities, clammy perspiration, excessive thirst, and death.

Diagnosis.—Hemorrhage of the bladder is liable to be mistaken for hemorrhage of the kidneys, the ureters, prostate gland, and urethra; and it need, therefore, hardly be added that the diagnosis is sometimes difficult, if not impracticable. In case of direct injury of the bladder by wound, calculus, or instrument, there need be no room for doubt. The nature of the lesion is sufficiently obvious. In the idiopathic form of the hemorrhage, however, great uncertainty must frequently exist. Under such circumstances, the history of the case, and the absence of disease or injury of the associated organs, may assist in clearing up the difficulty, and leading to a correct diagnosis. In renal hemorrhage, the disruption is usually dependent upon injury or organic disease of the kidneys, and is, therefore, apt to be preceded and accompanied by symptoms referable to these organs, such as aching, heat and pain in the loins, retraction of the testes, and an altered state of the urinary secretion, with, perhaps, some derangement of the general health. The blood is commonly of a pale, pink, or claret complexion, and either entirely fluid, or partly fluid and partly coagulated; it is never voided in a pure state, as it often is when it proceeds from the urethra or the neck of the bladder.

When the bleeding proceeds from the ureters, it is generally produced by the presence of a calculus, the passage of which lacerates some of the vessels of the mucous membrane, and gives rise to sudden

and violent pain, extending to the back and groins, intermitting in its character, and attended with retraction of the testes, distressing nausea, vomiting, cold sweats, and a sense of excessive prostration, and even faintness.

Hemorrhage of the urethra is generally produced by external violence, the passage of a calculous concretion, or the venereal orgasm, and the blood commonly passes off in small cylindrical or vermiform pieces, without any material change of color, or any desire to void the urine. In many cases the blood is discharged in drops, or in a small stream. It is worthy of remark that the same appearances may be present when the blood proceeds from the prostate gland, or the neck of the bladder, or, in fact, from any other portion of this organ, without mixing with the urine. It should also be borne in mind, that, in hemorrhage of the urethra, the blood may regurgitate into the bladder, where, uniting with the contents of that viscus, it may assume the aspect and consistence which belong to the blood in vesical hemorrhage. In such a case, it may be exceedingly difficult to establish the diagnosis as to the source of the bleeding.

Prognosis.—Hemorrhage of the bladder is serious or otherwise, according to the circumstances under the influence of which it is produced. In the traumatic form, as already stated, it may terminate life in a few minutes, or, at all events, be so copious as to induce great exhaustion of the vital powers. As an accompaniment of fungous and other tumors, it always portends danger, not, however, perhaps so much on its own account, as on account of the disease which gives rise to it, which is seldom amenable to treatment of any kind. The idiopathic form is in general easily managed, and therefore rarely fatal. The signs which indicate danger, in an attack of this description, are pallor of the face, nausea, vomiting, sighing, restlessness, small and feeble pulse, cold sweats, and general prostration with præcordial oppression. Hemorrhage may prove serious in another way; not by inducing fatal exhaustion, but by causing intractable retention of urine from the retention of coagulated blood.

Treatment.—In the treatment of vesical hemorrhage, attention must be paid to the nature of the exciting cause, which must necessarily, in all cases, exert a controlling influence in regard to our therapeutic agents. In the traumatic variety, the ordinary hemostatics are, of course, indicated, and should be employed without delay. Accessible arteries are exposed and tied, or, where this is impracticable, compression and cold applications are used. When the hemor-

rhage depends upon the presence of a foreign body, such as a calculus or worm, the offending cause is sought for and removed. When it proceeds from an encephaloid, fungous, or erectile tumor, palliation alone is attempted; for the morbid growth by which the bleeding is induced will be sure to progress, and at no distant day destroy life. In such cases, our main reliance is upon opium and lead, gallic acid, and alum, with acidulated drinks, rest in the recumbent posture, and cold applications to the perineum and hypogastrium. The catheter is carefully avoided, for its introduction could scarcely fail to re-excite the hemorrhage, by disturbing the morbid growth or the mucous surface in its immediate vicinity. In a case of vesical hemorrhage, dependent upon the presence of fungous excrescences of the bladder, and in which the loss of blood was frequent and sometimes considerable, I generally succeeded in affording prompt relief by a good dose of calomel and rhubarb, followed by alum and opium, with sulphuric acid and infusion of roses as a common drink.

In idiopathic hemorrhage of the bladder, great attention must be paid to the system; vascular action is reduced, the bowels are regulated, the secretions are corrected or improved, the diet must be light and unstimulant, and the drinks should be cooling and acidulated. Absolute rest in the recumbent posture is of primary importance. The internal remedies upon which reliance is mainly to be placed, are gallic acid, in doses of from three to five grains, acetate of lead, and sulphate of alum. These articles ought usually to be combined with opium, and be repeated every two, three, or four hours, according to the exigencies of each particular case. Tannic acid, matico, and sulphuric acid, also prove highly efficacious, and occasionally succeed where other remedies fail. When the hemorrhage is caused by an anemic state of the system, chalybeate tonics are indicated, and the best forms are the muriated tincture, the sulphate, and the aromatic wine of iron, in doses proportioned to the age of the patient and the tolerance of the stomach. In bleeding of the bladder, vicarious of the menstrual flux, emmenagogues and aloetic purgatives are required, to aid in restoring the function upon the suppression of which the discharge of blood depends. In all cases, the action of the internal remedies is promoted by refrigerant applications to the perineum, the inside of the thighs, and the hypogastric region. Cold enemata are also beneficial, and a lump of ice introduced into the rectum sometimes acts like a charm. When the hemorrhage is accompanied by pain and spasm, leeching and cupping over the sacrum may be useful. Direct medication, in the form of

astringent injections, such as solutions of alum, acetate of lead, and gallic acid, have occasionally proved serviceable, and should not be neglected in obstinate cases. Great precaution, however, is necessary in their administration, lest the catheter injure the mucous membrane, and thus increase the flow of blood.

In general, the blood which is poured out in vesical hemorrhage is dissolved by the urine, and thrown off by the natural channel. In some instances, however, especially when the secretion of urine is deficient, or the quantity of blood disproportionably large, the accumulated fluid coagulates and distends the bladder, which forms a hard firm tumor above the pubes, and leads to complete retention of urine, attended by the most urgent and distressing symptoms. To free the organ of its contents, under such circumstances, is often no easy task. The more simple means are of course resorted to first. With a silver catheter, introduced along the urethra, an attempt is made to break up the coagulated mass, and then to dissolve the pieces by the injection of tepid water and acetic acid, in the proportion of one ounce of the latter to five ounces of the former. Vinegar is a powerful solvent of blood, and is far better than water alone. The injections should be conducted with great care, and should be repeated two or three times in the twenty-four hours. Some of the smaller coagula may sometimes be removed by a syringe applied to the catheter, though such a procedure is, in general, quite ineffectual.

When all other means fail, and the symptoms are so urgent as not to admit of further delay, the only thing to be done is to open the bladder. The operation may be performed either at the perineum, or above the pubes, and is conducted in the same manner as for the removal of stone. When practicable, the lateral method should always be preferred, both on account of the facility of its execution, and the more dependent situation of the aperture.

Mr. Copland Hutchison, of England, in his *Practical Observations in Surgery*, has given the details of a case in which, owing to the firmness of the coagulated blood, and his inability to remove it in any other manner, he was compelled to perform the high operation. The hemorrhage, which was unusually copious, and which came on very suddenly soon after the evacuation of the urine, proceeded from two large fungoid tumors of the prostate gland, and caused immense distress. The patient, whose age was seventy-three, had labored for a long time under vesical symptoms, attended with a frequent necessity of voiding his urine, and severe pain in the pelvic

region. Of late years, he had occasionally an attack of retention, for the relief of which the catheter was used. The bladder was opened about twelve hours after the commencement of the hemorrhage, and the blood, amounting to upwards of a pint, and containing hardly any urine, was so firmly coagulated that it was obliged to be scooped out with a spoon. The man lingered until the sixth day, when he expired in a state of complete exhaustion, without any evidence of peritonitis or urinary infiltration.

CHAPTER XV.

RETENTION OF URINE.

SECTION I.

GENERAL OBSERVATIONS.

THE symptoms of retention of urine are generally well marked, even at an early stage of the complaint. In this respect, however, there is, as might be supposed, considerable diversity in different cases, depending mainly upon the natural tolerance of the bladder, and the character of the exciting cause of the disease. In paralysis of the muscular fibres of the organ, attended with loss of sensation, the accumulation may make great progress, and yet the individual not be aware of his real condition. A slight discharge of urine, perhaps, occasionally takes place; or if, as often happens, incontinence is soon superadded to the original disorder, the fluid dribbles off incessantly, and thus both patient and physician are lulled into a false security. When, on the contrary, the retention is inflammatory, more or less pain, and frequent inclination to void the urine, with inability to do so, attend the complaint, and at once expose its true character. In all cases, where suspicion points to the disease, a careful examination of the hypogastric region should be instituted, aided, if there be any obscurity, by the finger in the rectum or the vagina.

The tumor in the hypogastrium, formed by the distended bladder, fluctuates distinctly, especially when the retention is caused by paralysis; it is tender on pressure and percussion, and is fixed in its situation, or indisposed to obey the motions of the body. Pain

frequently exists at a very early stage, and steadily increases until, in many instances, it becomes agonizing. In protracted cases, more especially in the inflammatory form of the affection, it is often accompanied with forcing, straining, or bearing down sensations, similar to those in dysentery and parturition; and with rigors alternating with flushes of heat, thirst, and excessive restlessness; the patient tossing about in the wildest and most frightful manner. The urine, in the mean time, is discharged in gushes, jets, or drops, not in a full stream, or in any considerable quantity at a time. This symptom often sets in at an early stage of the complaint, and is apt to lead the unwary into error, by inducing the belief that the case is one of mere incontinence instead of retention. Such a mistake, unfortunately not uncommon, is often fatal to the poor sufferer; the proper means of relief are neglected, the accumulation progresses, and the bladder, distended to its utmost power of endurance, either mortifies or bursts; or more or less of the fluid is absorbed, and the patient dies under all the symptoms which denote the suppression of the renal secretion. The fatal event, however induced, is generally preceded by a typhoid state of the system; a small, shattered pulse; cold, clammy sweats; pale and shrunken features; hiccup and twitching of the tendons; nausea, extreme restlessness, urinous perspiration, and profound coma.

During the progress of the retention, the distended bladder, by pressing on the rectum, impedes the exit of the feces, and leads to pain and fulness of the bowels. From the same cause, there is sometimes partial prolapsion of the vagina, and, in both sexes, even of the rectum. When the tumor has reached its maximum development, it pushes up the diaphragm, and sensibly embarrasses the respiratory functions. The coats of the bladder, in the more severe forms of the affection, are attenuated, and, owing to the constant pressure which they experience, ultimately inflame, and are ready to give way under the accumulated suffering. In those who die, softened, ulcerated, or gangrenous patches are often observed; the valves of the ureters are forced apart; and the urine, highly vitiated and offensive, ceases to descend from the kidneys, or, as was before stated, ceases to be secreted.

The period at which death occurs in this affection varies in different cases and under different circumstances. Most patients, if not relieved, perish in five or six days; a few before that time, and a few not until later. The immediate cause of death may be rupture of the bladder, with effusion of urine into the peritoneal

cavity; exhaustion from mortification of the coats of the organ; or empoisoning of the system from suppression of the renal secretion.

Diagnosis.—When we consider its mode of origin, its progress, and its symptoms, which are usually sufficiently characteristic, it is difficult to conceive how retention of urine could ever be mistaken for any other complaint. Yet, strange as it may appear, some very singular, as well as very unfortunate, blunders have occasionally been committed in this respect, and that too by men who, from their skill and experience, ought to have known better. The affection with which it is most liable to be confounded is ascites, or dropsy of the peritoneal cavity. I subjoin the following cases in illustration of the subject, hoping they may serve as a beacon-light to prevent similar errors in future.

The first case is mentioned by Boyer,¹ upon the authority of Frank, an eminent German physician. A young man having received a fall upon his loins, became paralytic, and affected with incontinence of urine. Notwithstanding this, the abdomen enlarged prodigiously, and the surgeon was about to tap the patient, when an exploration of the bladder through the rectum, made at the suggestion of Frank, caused a discharge of urine by the urethra. A catheter was introduced, and at two operations twenty-four pounds of water were withdrawn. The instrument, which was retained at first in the bladder, was removed a few days before the death of the patient, on account of the excessive pain and distress in the lumbar region. Upon dissection, eighty pounds of urine were found in the bladder, which had pushed the diaphragm up into the chest, and greatly embarrassed the respiratory movements.

Wandœhren, a Dutch surgeon, had the candor to avow that he attended a woman whom he believed to be laboring under dropsy, but who died of retention of urine, not, however, before he had accidentally punctured the bladder.² A similar case is mentioned by Sir Everard Home.

A delicate female perceived that her abdomen was enlarging without any appreciable cause or special inconvenience; the distension was gradual, and was soon followed by anasarca, first, of the lower extremities, and then of the upper. The disease was pronounced ascites, and tapping was advised for its relief. The fluctuation of the tumor was quite evident. Before the operation was performed

¹ *Maladies Chir.* t. ix. p. 181.

² Chopart, *Maladies des Voies Urinaires*, t. i. 340.

some diuretics were prescribed; and it was ascertained, in the meantime, that there had been a total suppression of urine for three days. The catheter being introduced, eighteen pounds of urine were removed, followed by the subsidence of the abdominal tumor, and the disappearance of the anasarca.¹

On the other hand, dropsy has sometimes been mistaken for retention of urine. The elder Berard relates a case of the kind. The patient was supposed to be laboring under distension of the bladder; the catheter, as was conjectured, came in contact with a stricture, and was pushed on with so much violence as to pierce the bladder, followed by an escape of the ascitic fluid. The patient died, and the fact here stated was verified by the dissection of the body.²

In the above cases, the list of which might be considerably extended, the error in the diagnosis evidently arose from a superficial examination, and from a hasty conclusion in regard to the nature of the disease. Had the facts, as they existed, been carefully inquired into, there is no probability that any mistake could have taken place, much less such a serious one as happened in several of the cases. It is only in paralysis of the bladder followed by a gradual accumulation of urine, without any particular local distress, that difficulty of the kind will be liable to occur; but even here no man in his senses would be likely to tap a patient without a careful circumstantial examination of the case, more especially if there happened to be incontinence of urine. Such examples teach us the value of care, and the importance of taking nothing for granted.

An instance in which a distended bladder was mistaken for ovarian dropsy, is narrated in the second volume of the *London Lancet* for 1850. A young lady, aged twenty-three, had labored for a month under enlargement of the abdomen, attended with a very scanty discharge of urine. Her medical attendant, supposing her to be affected with ovarian dropsy, sent her to Mr. J. B. Brown, the reporter of the case. An examination detected a round, smooth, fluctuating tumor, the size of a foetal head, occupying the hypogastric region. The uterus was retroverted, the inferior extremity pressing firmly against the neck of the bladder. The organ being restored to its natural position, pressure upon the lower part of the abdomen caused an escape of urine by the urethra; a circumstance which thus at once revealed the true character of the swelling. A

¹ Boyer, *op. cit.* t. ix. p. 179.

² A. Berard, *Diagnostic Chirurgical*, p. 122. Paris, 1836.

catheter being introduced, seven pints of dark-colored, offensive urine were drawn off, when the tumor disappeared, never to return.

A careless practitioner might mistake a distended bladder for a supra-pubic abscess. A man, says Colot, had not relieved his bladder for eight days, when all of a sudden he voided a large quantity of urine. Notwithstanding this emission, the tumor, which existed above the pubes, did not diminish; the part, moreover, became hot and tense. The surgeon in attendance, believing there was an abscess, decided to puncture the swelling, when Colot, convinced of the contrary, introduced a catheter into the bladder; a large amount of urine came away, and the supposed abscess at once disappeared. The same lithotomist states that, on another occasion, he was instrumental in preventing a similar mistake.¹

An error of an opposite character occasionally occurs, a pelvic abscess being mistaken for a distended bladder. An instance, illustrative of this accident, took place, many years ago, in the hands of Dr. G. McClellan² and Dr. Physick, of Philadelphia, and is well-worthy of being reproduced in this place on account of its great practical interest. A young man, aged twenty-three, who had, about two years previously, swallowed a date-stone, was seized, one day, with what was supposed to be retention of urine. A large fluctuating tumor was discovered in the supra-pubic region, feeling and looking precisely like an over-distended bladder, and he complained of all the symptoms of a painful retention. The catheter having been introduced, not more than a tablespoonful of high-colored urine escaped, followed by but little relief. The finger was now inserted into the rectum, where it came at once in contact with what seemed to be an enormous distension of the lower fundus of the bladder, imparting a distinct sense of fluctuation when the swelling was struck above the pubes. The catheter was introduced again and again, first by Dr. McClellan, and afterwards by Dr. Physick, with no better effect than in the first attempt. During the last operation, blood appeared in the eyes of the instrument, and the patient felt conscious, during its passage, that something had been torn. Finally, a trocar was plunged into the supposed vesical tumor above the pubes, and to the astonishment of the two surgeons a large quantity of sero-purulent fluid escaped instead of urine. The man died in a few hours after the operation, and the dissection revealed the existence of a large abscess, which had evidently been

¹ Belmas, *Traité de la Cystotomie Suspuienne*, p. 63.

² *Principles and Practice of Surgery*, p. 135. Phila. 1848.

caused by the lodgement of the date-stone in the vermiform process, and the contents of which had partially surrounded the bladder, extending upwards into the hypogastric region, and downwards into the pelvic cavity, where it compressed the rectum, and was mistaken for a distension of the lower fundus of the urinary reservoir. It appeared that the catheter, during its last introduction by Dr. Physick, had entered the orifice of the right ureter, the mucous lining of which was torn to a considerable extent, and elevated by the infiltration of the subjacent cellular tissue, thus puffing up the parts like a blister.

The *characteristic* symptoms of this affection are, the existence of a hard, pyriform, circumscribed tumor, corresponding with the middle line, more or less tender on pressure, fluctuating, not affected by change of posture, and gradually increasing in volume; a frequent desire to void the urine, which, if passed at all, is discharged in drops, or small jets, never in a full stream or in any considerable quantity; uneasiness, and a sense of weight in the pelvic region, soon followed by pain and spasm; straining, forcing, or tenesmus at every attempt at micturition; at first, absence of fever, and then rigors, alternating with flushes of heat; and, in the latter stages of the complaint, excessive restlessness, an indescribable sense of oppression, urinous breath and perspiration, typhomania, and a Hippocratic condition of the countenance. In addition to these signs, which none but a heedless practitioner can mistake, there is also generally, after the first few days, a constant dribbling of urine, and the distended bladder can be easily felt by the finger in the rectum and the vagina.

In ascites, with which this affection is most liable to be confounded, the abdominal tumor is diffused, not circumscribed, and changes its form and situation with the position of the body; there is little or no tenderness on pressure and percussion; the sense of fluctuation is more distinct; the progress of the disease is more tardy; the urine, although more scanty than in health, is voided several times in the twenty-four hours, generally without pain or difficulty; there is commonly anasarca of the lower extremities; the skin is remarkably dry and harsh; and there is usually an absence of febrile disturbance, and always of typhomania and urinous perspiration.

Treatment.—The treatment of retention of urine is, in the first instance, by the catheter; no time is wasted in the hope of overcoming the difficulty by other means; the indication is to relieve the

distended organ with the least possible delay, and the instrument is therefore resorted to at once, before the part and the system have sustained serious mischief. Immediate relief follows the use of the instrument; the pains and other symptoms disappear; and the patient passes from a state of torment into one of entire happiness, similar to that of the poor female, who, after having been racked for several days with the most violent labor-pains, finds herself at length safely delivered of her burden, and is ready to sink into a profound slumber.

When there is great distension, amounting to several quarts, it is best and safest, as a general rule, not to empty the bladder at a single operation, but gradually, drawing off a portion of its contents now, and another by and by. The catheter is introduced, and half the fluid is evacuated, to afford the overstretched fibres an opportunity of contracting and regaining their power. Some hours afterwards the instrument is again used, and the remainder of the urine is withdrawn. Under this practice, there is less risk of inflammation of the bladder and of general exhaustion. Where this precaution is neglected, the abdomen should be supported with a compress and a broad roller, as after tapping and parturition. A large opiate should also be exhibited just before, or immediately after, the operation, premising, of course, that there is no contra-indication on account of cerebral oppression.

Retention of urine may be produced, first, by mechanical obstruction; secondly, by paralysis; thirdly, by spasm; fourthly, by inflammation; and fifthly, by the presence of a pelvic tumor. Finally, it may depend upon a miasmatic origin, as in the interesting case recorded by Sir B. C. Brodie. Hence, in order to understand the treatment of this affection, it is necessary to devote separate consideration to each class of causes.

I. The first class of causes may affect either the urethra, the bladder, or the head of the penis.

a. The *urethra* may be obstructed by an organic stricture, a calculus, clotted blood, coagulating lymph, inspissated mucus, or an enlarged mucous follicle. A catheter, bougie, or other foreign body may break off in the canal, and thus become an impediment to the egress of the urine. In 1848, I attended a gentleman, forty-four years of age, in whom retention was repeatedly caused by the arrest in the urethra of large pieces of solid and apparently organized lymph, some of them upwards of two inches in length. He had long labored under disease of the bladder, from the effects of which

he finally died. A considerable quantity of this substance is sometimes deposited in this canal, as a consequence of inflammation, where, gluing together its walls, it produces the same effect as an organic stricture.

The obstruction is occasionally produced by a small tumor, caused by the enlargement of a mucous follicle. The tumor varies in size from an apple-seed to a pea, is quite hard and firm, and feels as if it were embedded in the spongy body of the canal. Its situation is commonly in the anterior part of the urethra, but sometimes it is far back, or just in front of the neck of the bladder. When it acquires a considerable bulk, it may at length lead to complete retention, followed by ulceration of the tube behind the seat of the obstruction, extravasation of urine, and even death.

The treatment is regulated by the size of the tumor. The moment it begins to act obstructingly, the catheter, lubricated with some gently stimulating ointment, is introduced once a day, and kept in contact with the part for several minutes. Simultaneously with this, an attempt is made to promote its absorption by external applications, as the camphorated mercurial ointment, or some preparation of iodine. If these means fail, and the obstruction steadily increases, an incision is made through the spongy body, down upon the tumor, which is then removed with the knife or scissors.

The retention is sometimes occasioned by congenital occlusion of the urethra; of which, as will be seen elsewhere, there are several varieties of form. The most common species is that in which the meatus is closed by an extension simply of the mucous membrane of the head of the penis; in a second variety, the passage is obstructed by a thick, firm septum, situated at a short but variable distance behind the external orifice; while in a third class of cases, in which, however, the occlusion is generally comparatively slight, the obstacle depends upon an unusually small meatus, with very hard and slightly inverted edges. However induced, or in whatever form it may present itself, the obstruction is almost always easily overcome by the knife, aided by the catheter, the use of which should be continued until the parts are fully cicatrized, lest they should reunite and thus occasion a recurrence of the difficulty. When there is simple narrowing of the canal, seriously encroaching upon the stream of urine, a cure may often be effected by the steady and judicious use of the bougie alone.

The obstruction of the urethra, is sometimes associated with a patent state of the urachus, as in the memorable instance observed

by Barthélemy Cabriol,¹ Demonstrator of Anatomy in the Medical School at Montpellier, in the reign of Henry IV. The subject was a girl, eighteen years of age, who had always, from the moment of her birth, voided her urine at the navel, which was four inches in length, and bore a great resemblance to the comb of a turkey. It was constantly sore from the irritating effects of the discharges, and exhaled an intolerable stench. The obstruction in the urethra was formed by a thick, firm membrane, not unlike a hymen. This structure Cabriol carefully divided with the knife, when he introduced a leaden catheter into the bladder, in order to conduct off the urine, until the parts should be healed. On the following day, he cast a strong ligature round the projecting portion of the navel, which he then cut off close to the seat of the constriction, the operation being completed by the application of the actual cautery. As soon as the eschar was detached, the ulcer was dressed with a desiccative unguent, and in less than a fortnight the part was perfectly cicatrized.

The treatment pursued by Cabriol in the above case was as simple as it was successful. Modern science could not possibly improve it, except that it would omit the actual cautery, the application of which was entirely unnecessary.

Retention in the female is occasionally caused by maldirection of the urethra, or by the manner in which this tube mounts up in front of the pubes. The jet of urine, in consequence of this arrangement, passes upwards and forwards, and the catheter, to reach the bladder, must be inclined, at first, from above downwards, and then upwards and backwards.

Secondly, the obstacle may lie exterior to the urethra, and the consequences be the same as when it exists internally. Thus, an abscess in the perineum, if not timeously evacuated, may, by its pressure, force the sides of the tube so firmly together as to offer an effectual barrier to the flow of urine. Similar effects may result from a deep-seated collection of blood, an effusion of lymph, or the presence of a boil, a phlegmon, or a malignant tumor. Cancer of the penis, in its progress towards the bladder, and contusions of the perineum, with or without rupture of the urethra, are frequently followed by the worst forms of retention of urine.

It is obvious, from what precedes, that the treatment of retention of urine, caused by mechanical obstruction of the urethra, must vary according to circumstances. In organic stricture, the ordinary

¹ *Observat. Anatomic. Ob. 28.*

means are resorted to, and when these fail, our only resource is puncture of the bladder. Fortunately, however, this is rarely, if ever necessary, for even in apparently the most desperate cases, we may usually succeed, with patience and proper management, in entering the bladder. A silver catheter, of suitable size, is carried down to the seat of the obstruction, and, by steady but firm pressure, urged on towards the distended reservoir. Occasionally the immediate cause of the retention is spasm, excited by the irritable state of the stricture. In such circumstances, I have repeatedly succeeded in obtaining prompt relief by pressing the instrument for a few minutes against the anterior surface of the obstacle. Where the passage of even the smallest-sized catheter is impracticable, the stricture may be divided with the lancetted stylet, as described in a subsequent chapter. I confess I have great repugnance to puncturing the bladder, and should never think of resorting to it until all other means are exhausted. It is difficult to imagine a case where it would be really necessary.

An impacted calculus may, in general, be pushed back into the bladder or extracted with the urethra-forceps. Where these means fail, it is removed by incision, the patient being placed, if the offending body be lodged low down, as in the operation of lithotomy. Pieces of bougie or catheter, broken off and retained in the tube, are managed upon the same principles. Clotted blood, coagulated lymph, and inspissated mucus are easily displaced by the catheter, or forced out by the urine. When the sides of the urethra are glued together by adhesive matter, as occasionally happens in contusions of the perineum, the obstacle can only be overcome by the gentle use of the instrument. In such cases, false passages might be easily made.

When the obstacle is seated externally, and bulges inwards so as to occlude the canal, the knife supersedes the catheter, the use of which would be productive of much pain, especially in a perineal abscess. The parts are freely divided from without; the distension is instantly removed, and the urine is enabled to flow along the natural channel. When the obstruction is produced by extravasated blood, in consequence of a fall or kick, its absorption is promoted by the application of acetate of lead, muriate of ammonia, or spirituous embrocations. In retention from malignant disease of the penis, the bladder is relieved by puncture above the pubes. In contusions of the perineum without rupture of the urethra, the catheter is used; but when the accident is attended by laceration, a large incision is made, to save the tissues from urinous infiltration.

b. In the second place, the obstruction may be seated in the bladder. Of this class of causes the most frequent are, hypertrophy of the prostate gland, coagulated blood, inspissated mucus, coagulated lymph, and urinary concretions. The gravid uterus, or any other pelvic tumor, may, by compressing the neck of the bladder, give rise to the same effect.

The most common form of obstruction of the bladder, productive of retention of urine, is *hypertrophy of the prostate gland*. This affection, which is almost peculiar to old age, and which is generally the result of chronic inflammation, is liable to exist in various degrees, from the slightest change of volume to eight or ten times the natural bulk. The hypertrophy may involve the entire organ, or it may be limited to one of its lateral lobes, or even to its mammillary process. In most cases, all these parts are affected simultaneously, though not to the same extent. A very distressing and intractable form of retention of urine is occasionally produced by the mammillary process, or, as it is more commonly called, the third lobe of the prostate, which is often many times larger than in the healthy state, constituting a thick, triangular body, which closes the mouth of the bladder like a valve. When the hypertrophy is seated in one of the lateral lobes, the commencement of the urethra may be forced to one side, and in this way it may cause not only retention of urine, but offer great difficulty to the introduction of the catheter.

Retention of urine, dependent upon enlargement of the prostate gland, is usually of a temporary character, but is liable to be reproduced by the slightest exposure to cold, by irregularity of diet, by horseback exercise, sexual indulgence, or neglect to empty the bladder. During the attack, as well as for some time after, the urine is loaded with thick, tenacious mucus, and exhales an offensive ammoniacal odor, the calls to micturition are frequent and urgent, there is scalding in the urethra, with a sense of weight or throbbing in the perineum, and the patient often suffers indescribable torments. As the disease progresses, the bladder diminishes in capacity, so that it can scarcely hold an ounce of urine at a time, and its muscular fibres, thickened and hypertrophied, assume a retiform appearance, not unlike that of the fleshy columns of the heart. The kidneys are frequently diseased, and the urethra is almost always considerably elongated. In protracted cases, the retention is apt to be attended with incontinence, and the organ is rarely entirely emptied without instrumental aid.

The treatment is by the catheter; and one of silver is far prefer-

able to one of gum-elastic. It must be large in the curve, and at least two inches longer than in ordinary cases, otherwise it will fail to reach the distended reservoir. The instrument passes on without difficulty until it comes in contact with the enlarged gland, Fig. 63, when its progress is arrested. Instead of forcing it onward, the surgeon introduces the left index finger, well oiled, into the rectum,

Fig. 63.



and, placing it against the instrument, he guides its beak into the bladder, by pushing it gently towards one side or upwards towards the pubes, at the same time that he urges the handle on with the right hand. By this manœuvre, the obstacle is usually overcome without much trouble, however great the enlargement. To empty the bladder completely, it is necessary, as the point of the catheter cannot reach the cavity behind the gland, to raise the patient's hips, or turn him on his belly, so as to force the urine out of its hiding-place.

I am well aware that many highly respectable practitioners give a preference, in these cases, to the gum-elastic catheter; but, whatever may be said in its favor, I feel satisfied, from personal experience, that it is altogether inferior to the silver instrument. The former is soft, flexible, and easily bent upon itself when it meets with the slightest resistance; the latter, on the contrary, is firm, unyielding, and therefore well calculated, with proper care, to surmount every obstacle that may oppose its progress. Much time is frequently wasted, and much mischief done, in retention of urine from enlarged prostate, from the fruitless attempts which the practitioner makes to insert the gum-elastic catheter. Unless he has more tact in the use of the instrument, and more knowledge of the anatomy of the parts, than fall to the lot of most men, he will be almost sure to be baffled in nine cases out of ten; comparatively little skill, on the other hand, will enable him to pass a silver instrument.

Mr. Coulson,¹ of London, has recently recommended, in enlargement of the prostate gland, the use of a catheter with a very short, abrupt curve (Fig. 64); alleging that, in certain forms of that affection, it will pass with greater facility than the ordinary instrument. I have not had occasion to employ this catheter, but dare

¹ London Lancet, for 1854.

say it is worthy of trial, the more so as it has been suggested by so eminent an authority in the treatment of urinary diseases.

Fig. 64.



Dr. Physick, as early as 1796, employed, with great advantage, a catheter armed at the point with a piece of bougie. His patient labored under retention of urine from enlargement of the prostate gland, for the relief of which he attempted the introduction of an elastic catheter, but was completely foiled. Having previously passed a bougie, it occurred to him that he might succeed by securing the end of such an instrument to the end of a catheter. The expedient, as ingenious as it was simple, was accordingly tried, and the result was most satisfactory.¹ The same method was afterwards successfully employed in numerous other instances, and I mention it here as worthy of trial in difficult cases, or in those cases where the ordinary plans are found to be unavailing.

The bougie-mounted catheter of Physick, which was originally a very complicated instrument, may be advantageously replaced by a hollow bougie, somewhat conical in its shape, and having its eyelets from two to three inches from its vesical extremity. It should be of a tolerably firm consistence, and should be furnished with a flexible stylet, which will thus enable the operator to bend it into any form which it may be desired to give it.

When the enlargement of the prostate is associated with inflammatory symptoms, as it occasionally is when it is dependent upon engorgement rather than upon hypertrophy, properly so called, the treatment is by antiphlogistics, such as venesection, leeching, antimonials, the hip-bath, and anodyne enemata. The catheter is withheld, if possible, for fear of adding to the excitement. Undue distension is of course avoided.

Retention of urine from *coagulated blood* in the bladder, is a very serious affair. The fluid may be poured out by the bladder itself, descend from the kidneys, or regurgitate from the urethra, either as a consequence of injury or disease. However furnished, it soon coagulates, and thus offers a barrier to the flow of urine. When the quantity of blood is very large, which, however, cannot always be satisfactorily determined beforehand, relief must be sought by an

¹ Dorsey's Surgery, vol. ii. p. 187. Phila. 1813.

opening in the perineum, similar to that in lithotomy. Under ordinary circumstances, however, evacuation is attempted by a full-sized silver catheter, with four large eyelets, aided by injections of warm water, and an exhausting syringe. The water dissolves the blood, and renders its removal more easy. The usual hemostatic means are also employed. When the blood has been recently effused, in consequence of injury inflicted by the catheter, it is best to wait a few hours, sometimes as many as six or eight, until the fluid has subsided to the bottom of the bladder, or been dissolved by the urine. In such a case, the introduction of the instrument can do no good, since the blood plugs up the openings in its extremity, and thus prevents the passage of the water.

The beneficial effects of delay, in this form of retention, are strikingly exemplified in the subjoined case, which came under my observation several years ago.

CASE.—An old gentleman, seventy-two years of age, of a stout, robust frame, and temperate habits, had labored under retention of urine from paralysis of the bladder for nearly thirty hours, when he was seen by the late Dr. Pirtle, his family physician. He had had a similar attack about six years before, and subsequently he had an apoplectic seizure, which left the organ in a weakened condition, with occasional inability to expel its contents. At the time adverted to, the catheter, from some cause or other, became arrested in the posterior part of the urethra, and in the attempt to push it onward a copious hemorrhage was produced. I saw the patient about six hours after. The bladder, which formed a large tumor in the supra-pubic region, was somewhat tender on pressure, and there was a frequent desire to urinate, with a good deal of constitutional disturbance. Taking the instrument, a large silver catheter, I introduced it without the slightest difficulty, but not a drop of urine followed, although it was moved about in different directions. Upon withdrawing it, the eyelets were found to be filled with blood, which being removed, the instrument was again inserted, but with no better success. It was obvious that the difficulty depended upon the presence of a considerable quantity of blood, which had passed into the bladder during the first operations. As the symptoms were not very urgent, it was agreed to administer a large anodyne enema, and to wait until the next morning, it being now eight o'clock in the evening. Upon meeting at the time appointed, we learned that the old gentleman had passed a tolerably tranquil night, that he had had some sleep, and that there had been less thirst and fever than during the preceding day. I now introduced the catheter, and, much to our gratification, the urine flowed off in a full stream, nearly clear, to the amount of upwards of a quart. The blood, poured out eighteen hours previously, had evidently subsided to the bottom of the bladder, and thus allowed the urine to act the part of a supernatant fluid.

Retention, caused by *inspissated mucus*, coagulating lymph, worms, or calculous concretions, is, in general, easily relieved by the catheter, and does not, therefore, require special consideration. When it depends upon the pressure of the gravid uterus, the position of the latter should be rectified by the finger introduced into the vagina, aided by complete relaxation of the abdominal muscles.

Retention of urine is sometimes occasioned by pressure of the rectum upon the neck of the bladder. Anything having a tendency to cause inordinate distension of the bowel may induce such a condition, as an earthy concretion, or an encephaloid growth. In hemorrhoidal disease, especially the bleeding variety, retention of urine is by no means infrequent, and the same result now and then follows an abscess of the anus. Here relief must be attempted by a removal of the exciting cause.

c. Retention of urine may be occasioned by an *imperforate prepuce*. Many years ago I met with an instance of this kind, in an infant two days old, in which the foreskin was distended into a pellucid, fluctuating tumor, nearly as large as a pullet's egg. The little patient was in great pain, but was instantly relieved by a free incision, which was followed by at least four ounces of urine. Retention from an imperforate state of the urethra requires similar treatment. In the female, the flow of urine is sometimes obstructed by fleshy excrescences in the orifice of the tube. Excision is, of course, the proper remedy.

d. Retention of urine may depend upon *priapism*. This condition of the penis may be the effect either of inflammation, as in gonorrhoea, of direct injury, or of lesion of the cerebellum or spinal cord. Of the former variety, in which, however, the priapism seemed to be caused by an effusion of lymph into the cavernous bodies of the penis, an interesting case came under my observation, many years ago, in a stout, athletic, young carpenter, who, after having been drenched in a heavy rain, had connection with his wife on the following night. In the morning, when he awoke, the penis was in a state of painful érection, with complete retention of urine. The priapism continued nearly two weeks, and required the most vigorous antiphlogistic treatment, with the occasional use of the catheter. When the retention depends upon lesion of the brain or spinal cord, attention must be directed to the removal of the exciting cause.

II. Retention of urine from *paralysis* is of frequent occurrence. The most common causes of this condition of the bladder are, apoplexy, injury of the spine, over-distension of the organ, the effects of fever, contusions, lacerated wounds, and capital operations. In compression of the brain, whether produced by depression of the cranial bones, or effusion of blood, retention of urine is a prominent symptom, and a long time often elapses before we can dispense with the catheter. Injury of the spine is liable to lead to the same

result, and in this case the circumstances are peculiarly distressing; for, in addition to the loss of power, the urine is apt to be surcharged with phosphatic matter, followed by ulceration of the lining membrane. The effect of over-distension, in causing paralysis, is well exemplified in tedious labors, in which the head of the child presses long on the urethra, and the woman neglects or is unable to empty the bladder. When the child is born, she cannot void a drop of water. Old men are very prone to suffer from over-distension, in consequence of cold, external violence, the effects of disease, enlargement of the prostate gland, and neglect to obey the calls to urinate. If the catheter is not promptly employed, incontinence comes on, for which, unfortunately, the disease is frequently mistaken both by the patient and the surgeon.

The subjoined case affords an admirable example of this variety of retention of urine, both in its pathological and practical relations.

CASE.—Andrew Schneider, a German, aged sixty-five, in April, 1846, soon after having been exposed to cold, had a severe attack of retention of urine, which lasted nearly four weeks before it was fully relieved. He is married, and has been affected with double inguinal hernia for thirty years; his habits are regular and temperate. The catheter was obliged to be employed daily during the above period. A fortnight after the commencement of his illness, he was seized with rigors, and soon after with hemiplegia. The paralysis persisted for nearly a whole year, and he is still unable to make free use of the right hand, the fingers of which are bent and contracted. His articulation also remains somewhat imperfect, and is always worse in cold weather, and when there is derangement of the digestive apparatus. With the exception that his bowels are habitually costive, his general health is excellent. Since his first attack, the retention has frequently recurred, sometimes every three or four weeks, but generally at longer intervals. The slightest cold, derangement of the digestive organs, or increase of his constipation, is sure to bring it on. The retention is generally promptly relieved by a brisk cathartic and the use of the catheter, which the patient has learned to introduce himself. When the bladder is allowed to become a little more distended than usual, the retention is apt to be aggravated, both in duration and in the severity of the accompanying suffering. Sometimes one introduction of the instrument suffices, especially when it is performed within a few hours after the paralysis begins, but in general several are necessary before final and complete relief is obtained. I have now attended this man, off and on, for a period of nine years, and have never experienced, from first to last, the slightest difficulty in passing the largest-sized catheter. There is no enlargement of the prostate gland; nor, so far as I can determine, any organic disease of the bladder, ureters, or kidneys. The attacks are always attended with some pain and burning at the neck of the bladder and posterior part of the urethra, which, however, are generally very promptly allayed by catheterism. Sometimes an anodyne enema and hot fomentations are necessary; the patient has also derived benefit from the use of bicarbonate of soda, but the great remedy has always been active purgation, which, after the evacuation of the accumulating urine, has never failed to afford speedy and effectual relief. Within the last few years, the attacks of retention have become less frequent and severe, owing, apparently, mainly to the improvement of his general health.

The use of *anodynes*, in large doses, will sometimes induce temporary paralysis of the bladder, or, at least, such an amount of debility as to prevent it from expelling its contents without assistance. Of this variety of retention I have seen several well-marked examples. Not long ago I attended a medical gentleman, an eminent practitioner of Tiffin, Ohio, who, whenever he takes a full dose of morphia, opium, or laudanum, is sure to become affected in this way. It is proper to add that he has, on several occasions, suffered from hematuria. His age is fifty, and his habits are perfectly temperate, though his health has been a good deal impaired by the active duties of his profession.

In low *fevers*, especially when delirium is present, in compound fractures and dislocations, in lacerated wounds, in contusions of the abdomen, and in strangulated hernia, frequent inquiry should be made into the condition of the bladder, in order to guard against retention, or to relieve it speedily, if it be found to be unavoidable. From want of attention to this subject, many lives are lost. I always make it a rule, after performing a capital operation, to ascertain, at my first visit, whether my patient has voided his urine.

The liability of this form of retention to be followed by incontinence cannot be too strongly, or too frequently, urged upon the attention of the reader. The inexperienced practitioner, seeing the incessant dribbling of urine, will be almost sure to mistake what is merely a symptom for the main, if not the only, ailment. The consequence is that the case is generally suffered to go on unrelieved until it is too late to interpose the only remedy calculated to be of any avail. The mistake is the more liable to happen, because many of the patients thus affected are unconscious of their real condition, and therefore unable to afford the attendant the slightest aid in its investigation. It is to this form of the affection that I shall venture to apply the term *incontinence of retention*, in the hope that, by an antithetical expression, I may be able to attract to it the particular attention of medical practitioners.

Retention from paralysis is relieved by the catheter, employed early, and steadily until the bladder regains its contractility; the instrument passes without difficulty, and the urine is drawn off at regular intervals, at least three times in the twenty-four hours. Any considerable accumulation is prevented, and it is better to reintroduce the catheter frequently than to permit it to remain. Indeed, it is only under peculiar circumstances, as when the physician is at an inconvenient distance from his patient, or where the

passage of the instrument is attended with unusual difficulty, that it should be retained in the bladder. In the latter case, the catheter is stopped up, and the urine evacuated at stated periods, otherwise, as the natural stimulus of the organ is absent, a longer time must necessarily elapse before the muscular coat recovers its wonted functions. When the return of contractility is slow and imperfect, gentle but steady purgation, the internal use of strychnine, or of cantharides and the muriated tincture of iron, the cold bath, vesication of the sacro-lumbar region, and irritating frictions to the spine, will be of advantage. In retention from traumatic paralysis, the treatment is conducted upon general principles. The catheter is used from time to time, the secretions are properly attended to, and the usual means are employed to improve the tone of the muscular system.

When the loss of power is dependent upon the use of anodynes, cold applications to the head, the hypogastrium, perineum, and genitals, will usually suffice to afford relief, without the aid of the catheter. The gentleman, whose case is adverted to in a previous paragraph, generally relieves himself promptly by pouring water slowly from a pitcher into a basin. The noise thus occasioned immediately excites the bladder to energetic contraction, followed by the expulsion of its contents. The same effect I have known to result from standing on the cold floor, or on a cold hearth-stone, and from pouring cold water, from a considerable height on the hypogastric and perineal regions. In the female, relief might be obtained by injecting cold water into the vagina; and in the male, by throwing it into the rectum.

Retention of urine from paralysis of the bladder, whether induced by traumatic or internal causes, often ceases very suddenly, the organ waking up, as it were, from a profound sleep. A few months ago, I attended a man for an injury of the spine, produced by a fall from a scaffold, who, for nearly a fortnight, required the use of the catheter twice a day. His extremities, both upper and lower, were completely paralyzed, and so continued until his death, about ten weeks after the accident; but, strange to say, the bladder, at the time above specified, one morning suddenly recovered its expulsive power, and retained it up to the close of life. In apoplexy, the same thing is occasionally witnessed, though, in general, the restoration of the functions of the organ is more slow and gradual.

Under this head may be noticed a variety of retention of urine, which is occasionally met with in *hysterical* females, and which seems

to be dependent rather upon a deficiency of volition than upon paralysis of the muscular fibres of the bladder. The patient cannot, or thinks she cannot, urinate, and therefore does not try to relieve herself. The affection is, in general, only temporary, but may last for several days or even weeks. Purgatives, assafoetida clysters, and the internal use of antispasmodics, are the remedies mainly to be relied upon. Cold water, poured upon the sacro-lumbar region in a continuous stream, from a height of three or four feet, often affords speedy relief. The catheter must, if possible, be avoided, and in all cases, especially when there is reason to believe that the complaint is feigned, it is of great importance not to encourage the patient by an appearance of commiseration.

In the subjoined case, drawn up by Dr. William H. Lyle, the disease was of a mixed character, with a marked predominance of hysterical symptoms.

CASE.—Eliza Hearne, aged 20 years, a stout, laboring woman, a native of Ireland, was admitted into the Louisville Marine Hospital, on the 15th of July, 1854, on account of an attack of remittent fever. Up to this period she had always enjoyed excellent health, and had never suffered any derangement in her menstrual functions. Her fever soon disappeared, and in a few weeks she was discharged cured. About the period of her menstrual return, she took a severe cold, for which she re-entered the hospital on the 18th of August. She complained of intense pain in the region of the womb and bladder, with a frequent desire to pass water, tenderness in the hypogastric region, pain in the back and loins, constant headache, and occasional disturbance of the stomach. The urine was voided with great difficulty, and generally in quantities not exceeding six or eight ounces. These symptoms were considered by the physician then in attendance, as of a neuralgic character, and were treated accordingly, but without any signs of amendment, the patient meanwhile growing worse. It now became necessary to introduce the catheter twice in the twenty-four hours, to draw off the urine, the amount of which varied at each operation, from a third of a pint to a quart. Occasionally, indeed, not more than a few drops followed the use of the instrument. The pain was always intense as the catheter passed the neck of the bladder. Her suffering was greatly increased at the return of the next menstrual period, so that she was not able to empty the bladder without assistance. But the discharge had hardly ceased, before the symptoms assumed an hysterical character. To relieve her distress, she was ordered, every five hours, ten grains of assafoetida, two grains and a half of camphor, and half a grain of morphia. Under the use of these remedies she experienced, after a few days, great amelioration, and voided her urine without much pain or difficulty. An alternative plan of treatment was then adopted, but failed to do her any good. Diuretics were next ordered, but these served only to increase the quantity of urine, while she was still unable to pass a drop without assistance. In this condition she was transferred to the surgical ward, and placed under my care in the latter part of November.

A careful examination being made with the sound, no foreign body was found in the bladder, but the finger, inserted into the vagina, discovered the uterus in a state of partial displacement, and very tender to the touch. A few small excrescences, situated around the orifice of the urethra, although free from pain, were at once removed. The

position of the uterus was rectified, and a large blister was applied to the sacro-lumbar region. Rapid amendment ensued; the woman menstruated with less pain, her hysterical symptoms began to disappear, and in a short time she was able to void her urine without the aid of the catheter. For the last three weeks she has been entirely free from vesical disease, and her general health is now nearly as perfect as ever.

I attribute much of the success in this case to the influence of the moral part of the treatment. But for my threats to employ harsh remedies, if rapid amendment did not ensue, I believe that the introduction of the catheter would have been necessary a much longer time. When the girl found that the real nature of the case was understood, she used every effort to overcome her urinary difficulty, and speedy relief was the consequence.

The following observations of Dr. Watson, of London,¹ on this subject, are so just and pertinent that I am induced to transcribe them in full. Speaking of hysteria, he says: "Some of the shapes assumed by this pathological Proteus are hideous and disgusting. Paralysis of the muscular fibres of the bladder, or spasm of its sphincter, sometimes really occurs, sometimes is only aped, in hysteria. It is a common trick with these patients to pretend that they are laboring under retention of urine; and that, although the bladder is full, they cannot make water. The daily introduction of the catheter by a dresser or an apprentice, appears to gratify their morbid and prurient feelings. Sometimes, no doubt, the difficulty is real; but it is oftener feigned or exaggerated. I have again and again known it disappear upon the patient's being left without pity to her own resources. But, girls have been known to drink their urine, in order to conceal the fact of their having been obliged and able to void it. The state of mind evinced by many of these hysterical young persons is such as to entitle them to our deepest commiseration. The deceptive appearances displayed in the bodily functions and feelings find their counterpart in the mental. The patients are deceitful, perverse, and obstinate: practising, or attempting to practise, the most aimless and unnatural impositions. They will produce fragments of common gravel, and assert that these were voided with the urine; or they will secrete cinders and stones in the vagina, and pretend to be suffering under some calculous disease. A young woman contrived, in one of our hospitals, to make the surgeons believe that she had stone in the bladder, and she actually submitted to be placed upon the operating table, and to be tied up in the posture for lithotomy, before a theatre-full of students; and then the imposture was detected. Sometimes they

¹ Lectures on the Practice of Physic, by Condie, p. 430. Philad. 1845.

simulate suppression of urine, and after swallowing what they have passed, vomit it up again, to induce the belief that the secretion has taken place through the new and unnatural channel."

A species of retention of urine, dependent upon deficient volition, is sometimes met with in the male, as the following case will testify.

CASE.—J. B., about twenty-one years old, a medical student, of rather delicate constitution, and nervo-melancholic temperament, had always enjoyed good health until the age of eighteen, when he was seized with inflammation of the bladder, attended with fever and retention of urine. The use of the catheter became necessary, under which and other means, the more urgent symptoms gradually disappeared. Although the bladder had regained its expulsive power, he was annoyed with frequent calls to urinate, which were always painful, and occasionally accompanied with discharges of blood. Pains continued to dart along the urethra and kidneys, the stream of urine was often suddenly interrupted, and whenever he wished to relieve himself he was obliged to stoop, in order to facilitate his object. He was sounded for stone, but none was discovered. The operation had the effect of re-exciting cystitis in nearly all its original severity. On recovering from this new attack, he felt quite well, but had some difficulty in starting his urine. This, after the lapse of three weeks, was followed by another attack of retention. There was now an entire absence of pain, with only moderate distension of the bladder; gradually, however, the distension increased, and he was again obliged to use the catheter, at first, once a day, or once every other day, and then twice a day, for nearly a fortnight. As the retention subsided, he was seized with irritability of the bladder, in consequence of which he was compelled to void his urine from twenty to thirty times in the twenty-four hours.

Becoming debilitated and despondent, the young gentleman now retired into the country, where the change of air and gentle exercise gradually improved his whole condition, so much so, that, in the course of a month, he was to all appearance perfectly well. For about a year, his health remained excellent; but, at the end of this period, he was again seized with retention, but did not this time require the use of the instrument more than two or three times. Of late, he has suffered only occasionally—generally without any appreciable cause—sometimes with, and sometimes without, distension of the bladder. Very close study, mental anxiety, or physical exhaustion, induced by over-exertion, will now and then produce an attack, which, however, is commonly promptly relieved by food and rest. A dose of opium will almost certainly bring it on, and demand the introduction of the catheter.

But, perhaps, the most remarkable feature of this Protean case is the fact that it is liable to be greatly influenced by mental emotion. For example, whenever my patient travels, his mind always becomes deeply absorbed by his ailments; he fancies that he will be unable to pass his urine, and the consequence is that, when he makes the effort, he utterly fails, no matter how powerfully he may exert himself. As soon, however, as he goes to some retired place, he can relieve himself with the greatest facility. He has tried this experiment repeatedly, and always with the same result. It is evident that the inability here, as in the hysterical female, exists not in the bladder, but in the volition of the individual.

III. Retention of urine from *spasm* of the neck of the bladder, or of the urethra, is commonly produced by cold, by suppression of the cutaneous perspiration, by the irritation of ascarides, hemorrhoidal tumors, or stone in the bladder, by disorder of the digestive

apparatus, by the use of fermented, vinous, or alcoholic drinks, by high-seasoned food, and by the effects of cantharides. The remitting pains, the violent straining, and the frequent desire to urinate, clearly indicate the nature of the complaint. The warm bath, hot fomentations, either simple or medicated, and the inhalation of chloroform, followed by the free use of camphor and opium, or of laudanum and sulphuric ether, either by the mouth or rectum, generally afford prompt relief. Sometimes cold applications answer better than warm, as a bladder of pounded ice placed upon the perineum and the genitals, or cold water poured in a continuous stream upon these parts and the hypogastric region. When the symptoms are urgent, recourse is had to the catheter, which often overcomes the spasm in an instant, long before it has reached the bladder. When the introduction is difficult, the instrument should be gently pressed against the obstruction, and then suddenly withdrawn; a manoeuvre which rarely fails to be followed by a free discharge of water.

IV. Retention of urine may be produced by *inflammation* of the urethra and the neck of the bladder. The most common exciting causes of this form of the disease are gonorrhœa, horseback exercise, the long-continued use of cantharides, hard drinking, and venereal excesses. The symptoms are, a frequent desire to urinate, with an inability to pass more than a few drops of water at a time; a sense of smarting, burning, or scalding, in the urethra and the head of the penis; violent straining; a feeling of weight about the anus; and throbbing in the perineum. Occasionally, the urine is mixed with blood or pus. If relief is not soon procured, the distended bladder ascends above the pubes, and becomes extremely painful to the touch; the patient is feverish, thirsty, and restless; the pulse is hard and quick; the skin is hot and dry; nausea and vomiting succeed; and not unfrequently there is considerable delirium.

The treatment is of course antiphlogistic. Perfect recumbency is enjoined; blood is freely taken from the arm, or by leeches from the perineum; the stomach is kept under the full influence of nauseants; and cloths, wrung out of hot water and laudanum, are applied to the hypogastric region. Spasm is allayed by anodyne enemata, and mucilaginous drinks are not neglected. The warm bath is often eminently useful, especially after thorough venesection. The bowels are moved by mild laxatives, as Epsom salts, or calcined magnesia; but all drastic cathartics are carefully avoided, since, by irritating the large intestine, their tendency is to fret the bladder and induce spasm. When the symptoms are urgent, and the

means here indicated are inefficacious, the catheter must be used, but not without the greatest care and gentleness. As the instrument, if retained in the inflamed bladder and urethra, would only be calculated to create mischief, the rule is to withdraw it as soon as the urine has been evacuated.

In inflammatory retention of urine, accompanied by spasm of the bladder and urethra, prompt and decided relief has occasionally been obtained from the exhibition of a tobacco enema, in the form of smoke or infusion. The employment of this medicine in the treatment of this affection was, I believe, originally proposed by the late Mr. Henry Earle, of London, in a paper in the sixth volume of the *Medico-Chirurgical Transactions*. The powerful effects of the article in strangulated hernia, first led him to administer it in obstinate retention of urine; and in the work adverted to he has detailed the particulars of three cases in which its exhibition was attended with the happiest result. The enema was prepared with one drachm of tobacco to eight ounces of water, the whole of which was thrown into the bowel at one operation. This was speedily succeeded by great muscular relaxation, copious perspiration, and a disposition to syncope, followed by a free discharge of urine, and complete relief of the disagreeable symptoms.

I have, I confess, in common with many members of the profession, almost an invincible repugnance to the employment of a remedy so violent in its action, and so difficult to control as tobacco. Now that the surgeon has chloroform and sulphuric ether at his command, hardly any case can arise demanding its exhibition. Nevertheless, a contingency might occur, as when it is impossible to unburden the bladder in consequence of excessive narrowing of the urethra, with violent spasm and straining, in which, after all other means have failed, it might be proper to resort to it; not, however, in the large dose recommended by Earle, but in small quantity, the effects of the remedy being sedulously watched, that the patient may not be brought to death's door. For, it should ever be borne in mind that the action of tobacco varies greatly in different individuals, and that it has occasionally produced the most alarming prostration; nay, even death. It ought not, therefore, to be adopted indiscriminately, but be reserved for those cases in which the ordinary means, aided by anæsthetic agents, have failed. Under such circumstances only can its administration be justifiable.

V. Retention of urine may, in the fifth place, depend upon the presence of a *pelvic tumor*. Of this class of causes, several varieties may be enumerated.

a. The difficulty may arise from the presence of a *serous cyst*, or hydatid, between the bladder and the rectum. Of this, an instructive example has been furnished by Lesauvage,¹ which may, with much propriety, be reproduced in this place. A man, sixty years old, having several tumors in the abdomen, was seized repeatedly with retention of urine, for the relief of which catheterism was always performed with difficulty. Finally, the introduction of the instrument was rendered impossible, arrested as it was at the neck of the bladder. The abdominal tumor offering an insurmountable obstacle to the hypogastric operation, the bladder was punctured through the rectum, with so much the more confidence, as the finger, introduced into the anus, felt a soft, fluctuating swelling. The trocar had hardly pierced the organ, when there was an abundant flow, both by the canula and the urethra, of a fluid of very different qualities; one was evidently urine, the other the contents of a cyst, which, situated between the rectum and the bladder, opposed the flow of urine by compressing the neck of the latter organ.

b. Inordinate distension of the *rectum* may be mentioned as another cause of retention of urine; the obstruction may proceed from excessive accumulation of feces, or from the impaction of a large quantity of undigested food. Some years ago, a man, aged sixty, was brought to King's College Hospital, London,² with retention of urine, caused by the lodgement in the rectum of upwards of a pint of common gray peas, which had been swallowed, in a dry state and almost without mastication, six days previously. They had undergone no change in the stomach, but, in their transit through the bowel, they had become swollen by the absorption of moisture, and the greater number had accumulated in the rectum, where they formed a solid mass which occupied almost the entire pelvic cavity, and which, by compressing the urethra and the neck of the bladder, had effectually prevented the discharge of the urine. It was with no little difficulty that a catheter could be introduced after death. The bladder was excessively distended, its summit reaching to the umbilicus, while its base was pushed up by the distended rectum, and compressed the colon, which, together with the small intestine, was filled with gas. The man, in addition to his retention of urine, had been laboring under obstruction of the bowels, attended with severe pain in the abdomen, and bilious vomiting, for which he had taken purgative medicines, but without effect; and he expired in a

¹ Bulletin de la Faculté de Méd. p. 489, 1813.

² Dr. George Johnson, London Medical Gazette, vol. xxx. p. 805.

state of exhaustion almost immediately after his admission into the hospital.

The proper remedy for this form of retention is clearance of the rectum by means of the scoop, spoon, or forceps, according to the nature of the obstructing substance, aided, if necessary, by stimulating injections. When the symptoms are urgent, the catheter should be used; but it would be difficult to conceive of a case in which it would be proper to puncture the bladder.

c. Retention sometimes arises from *prolapsus of the uterus*. The most effectual means of relief is to replace the dislocated organ, by pushing it upwards and backwards while the patient is recumbent. The introduction of the catheter is rarely required.

d. The obstruction may depend upon *retroversion of the uterus*. In this affection, the dislocated organ drags the posterior part of the bladder downwards and backwards, at the same time that it raises the neck of this reservoir, and places it, as it were, behind the pubic symphysis. The necessary consequence of this malposition is an increase in the length and curvature of the urethra, the concavity of which is directed forwards. The remedy consists, of course, in replacing the uterus. When the reduction is not immediately practicable, or when it fails to afford relief, the catheter must be employed, taking care to give it the proper curvature, and to keep it in close contact with the posterior surface of the pubic bones.

e. Retention of urine occasionally takes place during *utero-gestation*, from the pressure which the womb exerts upon the bladder. The accident is liable to happen chiefly at two periods; first, a short time before the occurrence of quickening, and secondly, during the last three months of pregnancy. In either case, the immediate cause of the retention, as already intimated, is the pressure which the distended organ exerts upon the neck of the bladder, which is often sadly dragged out of its place, remarkably flattened, and eventually almost paralyzed, especially if it be not timeously relieved of its burden. The treatment consists in the introduction of the male catheter and the rectification of any malposition that may exist on the part of the impregnated uterus. The common female catheter is generally unavailing in such cases, on account of its small curve, in consequence of which it is usually impossible to carry it upwards behind the pubic symphysis, the direction taken by the displaced urethra.

f. Distension of the bladder sometimes occurs during *parturition*. The bladder mounts up into the abdominal cavity, and drags the

urethra up behind the pubic symphysis, against which it is sometimes so closely applied as to render it difficult to introduce a catheter. Distension of the organ, under such circumstances, is particularly to be dreaded, as it has occasionally been followed by laceration of its coats, and the escape of the urine into the peritoneal cavity.

VI. Finally, there is a form of retention of urine, which may be said to be *periodical* in its character, as it comes on at a particular time very much like an attack of intermittent fever, being evidently dependent upon similar causes. It was first described by Sir Benjamin Brodie, in his work on the urinary organs, in which a case will be found illustrative of its nature and treatment. The retention occurs at a certain period of the day, and, after having continued for some hours, it either disappears spontaneously, the bladder gradually regaining its expulsive power, or, as perhaps more commonly happens, relief is obliged to be afforded with the catheter. The organ then recovers its natural tone, and retains it until the time arrives for another attack, which usually happens about the same period every other day, thus bearing the closest resemblance to a tertian ague. There can be no doubt that the immediate cause of this affection is malaria, the effects of which explode upon the muscular fibres of the bladder, temporarily irritating and paralyzing them, and thus disqualifying them for the discharge of their proper functions. The treatment must, of course, be by quinine, either alone or in union with arsenic and other anti-periodic remedies; the bowels and secretions must receive due attention; and the distended bladder must be promptly evacuated with the catheter.

The following is an abstract of Mr. Brodie's case, above referred to:—

A gentleman, for a long time a resident in a hot climate, had an old stricture of the urethra, for the relief of which he had been in the habit of passing, at regular periods, a bougie. For many years he had experienced little or no inconvenience from his disorder. One night, however, he was seized with retention of urine, for which he called Mr. Brodie out of his bed. "I introduced," says this gentleman, "a gum catheter, which entered the bladder with perfect ease, and drew off the urine. He called me up another night, and another, and another still; and one night he called me up twice. At last it occurred to me that he always sent for me on the alternate nights; and, on inquiry, I found that the attack of retention regularly came on about twelve o'clock, and even though the catheter had entered the bladder, the spasm did not relax, so as to enable him to make water by his own efforts, until five or six in the morning. I determined then to treat the case as we do other intermitting and periodical diseases; and I prescribed him the sulphate of quinine. The first night after he began to take it he had an attack of retention; but he had no attack afterwards."

SECTION II.

CATHETERISM.

The introduction of the catheter, although apparently very simple, is one of the nicest and most delicate processes in surgery. It requires skill of the highest order, as well as the most intimate knowledge of the anatomy of the urinary organs. If I were called upon to state what I considered as the most important operation that a practitioner is obliged to perform, I should unhesitatingly say the introduction of the catheter. It is true, the most untutored and awkward surgeon may occasionally, nay, perhaps not unfrequently, reach the bladder without difficulty; but let such an individual attempt the passage of the instrument when there is some mechanical obstacle, as a stricture or an enlarged prostate, and he will be sure to be foiled. The moment the catheter is arrested he becomes bewildered; his hand trembles, dismay is depicted in every feature, large drops of sweat stand upon his brow, and his whole frame is paralyzed. If, under these circumstances, he proceed, he will inflict severe suffering upon his patient, if not actually endanger his life. To avoid such an occurrence, as disgraceful as it is unfortunate, the operation should be constantly practised upon the dead subject; the anatomy of the urinary apparatus should be thoroughly studied; and the eye, hand, and instrument should be trained to move in concert with each other.

Catheters are cylindrical tubes, varying in their composition, size, and shape. The best are made of silver (Fig. 65), and are, for an adult, about nine inches and a half long, by two lines and a half in diameter; they are perfectly smooth, light, and bent for one-third of their length, to accommodate them to the natural curvature of the urethra. The vesical extremity, which is rounded off, but closed at the point, and of the same thickness as the rest of the instrument, has an oval hole on each side, a quarter of an inch long and about a line and a half in width, for the entrance of the urine. Instead of this arrangement, this part of the tube is sometimes pierced with numerous little apertures (Fig. 66), but these are objectionable, because of their greater liability to become clogged with blood and mucus. For the removal of urine, mixed with these substances, I have recently had a catheter constructed with eight eyelets, two on each side, two in front, and two behind. The other extremity, usually called the handle of the instrument, is open, and is provided on each side with a small ring, for securing it in its place when it is

necessary to retain it in the bladder. The French have a convenient silver catheter, which they carry about with them in their pocket cases; it consists of two pieces, united by a screw, and is therefore

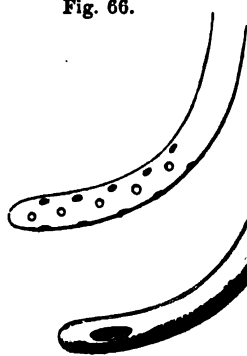
Fig. 65.



Fig. 67.



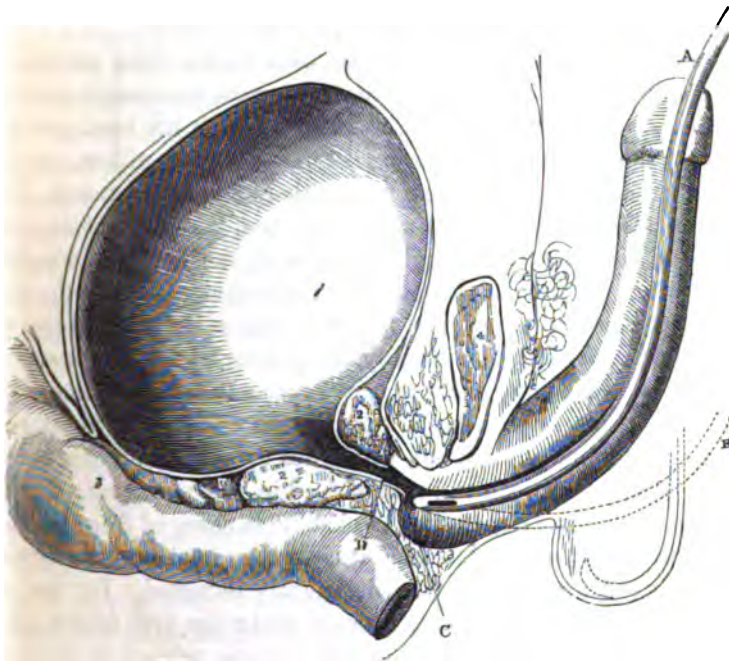
Fig. 66.



well adapted for either sex. The gum-elastic instrument, so much lauded by some practitioners, I seldom resort to. It is very liable

to bend whenever it meets with the slightest resistance, and is, moreover, easily injured by the urine. Nevertheless, it may occasionally be employed with advantage, especially if it be rendered firm by the stylet. Every practitioner should have an assortment of catheters, of different dimensions, that he may be prepared for emergencies. For a child, from a few months to several years old, a tube, five inches long, and about the size of a crow-quill, will be sufficiently large. The straight catheter, although easily introduced, is not much in vogue. For washing out the bladder for the removal of blood and mucus, or for introducing medicated fluids, a double catheter is necessary (Fig. 67). When used for the first of these purposes, it may be constructed of gum elastic; but when the object is to throw up some medicated fluid, such as nitric acid and water, a gold or silver instrument is required.

Fig. 68.



Section of the pelvis, showing when the handle of the catheter ought to be depressed to disengage its point from the sinus of the bulb. 1. Is the bladder. 2, 2. The prostate gland; the seminal vesicle is seen behind the gland. 3. The rectum. 4. The out surface of the pubic symphysis. A. The catheter is introduced into the urethra as far as the bulb. B. The dotted line which indicates the direction in which the handle of the instrument is to be lowered to lift the beak out of the sinus of the bulb. C. The inferior margin of the opening in the triangular ligament of the urethra, and against which the point of the catheter frequently hitches. D. Is another point at which the beak is sometimes arrested.

When the urethra is entirely sound, a tolerably large catheter, one that will gently distend the parietes of the tube, is selected. An instrument of this size will, in general, glide along much more easily than a smaller one, since it is not so liable to be arrested by the folds and follicles of the mucous membrane, or to impinge against the margins of the opening in the triangular ligament. Before introducing it, it should always be well oiled, and carefully warmed by rubbing it between the thumb and fingers, or by plunging it into hot water.

The catheter may be *introduced* while the patient is standing, sitting, or lying; but, whatever posture may be selected, it is important that the thighs should be moderately separated from each other, and flexed upon the pelvis, to relax the abdominal muscles. In the first case, the patient leans with his back against the wall, and inclines his chest slightly forwards, so that he may not change his position during the operation. The surgeon may take his place either at the front or side. If he sit, the breech should project over the chair, and the body be directed backwards. The position of the operator is the same as before. The most convenient posture, however, is the recumbent. The patient lies on his back, near the edge of the bed, the head being supported by a pillow, and the knees, slightly separated from each other, somewhat raised. The surgeon, standing by the left side of the bed, takes the penis in the left hand, and lifts it to a right angle with the body, to efface the curve which it forms at the pubes. The catheter, held in the right hand, between the thumb and first two fingers, is inserted into the orifice of the urethra, its concavity being directed towards the pubes, and the handle being nearly in contact with the median line of the abdomen. The instrument is now passed onward, until its beak reaches the sinus of the bulb, which lies upon the anterior surface of the triangular ligament, rather deep in the perineum. To disengage it from this depression, the handle is changed from the horizontal direction, in which it has hitherto been held, into the vertical, at the same time that the point is slightly retracted. By this manoeuvre, the curved portion is brought under the arch of the pubes, and immediately opposite the opening in the triangular ligament. By now depressing the handle of the instrument on a level with the thighs, or, rather, a little between them, its point glides readily over the prostatic part of the urethra into the bladder.

In performing this operation, no force is employed; on the contrary, the whole proceeding is conducted with the utmost gentleness.

The catheter, held as lightly as possible, is made to glide along, as it were, by its own weight and by that of the hand. The penis should be drawn slightly forward over the instrument, just sufficiently to render the urethra a little tense. Everything like stretching and pulling must be avoided.

In introducing the straight catheter, the patient lies on his back, and the surgeon stands on the right side of the bed, instead of on the left, as in the other case. The penis is held in the left hand, at a right angle with the body, and the instrument is carried down perpendicularly as far as the sinus of the bulb. To free it from this depression, the point is retracted two or three lines, and then, while the penis is lowered between the thighs, it is at once pushed onward into the bladder.

The natural *obstacles* to the passage of the catheter are the mucous follicles, the sinus of the bulb, and the margins of the opening in the triangular ligament. The first is easily avoided by using a large instrument with a rounded instead of a conical point; the second, by withdrawing it two or three lines before it is pushed on; and the last, by carrying it parallel with the raphé of the perineum, and not more than an inch below the arch of the pubes. The orifices of the prostate gland, the outlets of the seminal ducts, the sinus pocularis, and the gallinaginous crest, can hardly be considered as offering any opposition to the progress of the instrument. When the prostate gland is enlarged, the finger, introduced into the rectum, will enable the surgeon to push the catheter forward toward the pubes, or toward either side, as circumstances may require.

Difficulty is occasionally experienced in entering an instrument at the external meatus. I have repeatedly encountered this impediment, both in ordinary catheterism, in sounding, and in lithotomy. In general, it is produced by an unusually narrow orifice, attended with very hard, tight edges, evincing but little disposition to dilate; sometimes it is caused by a hypospadiac condition of the part; and in some instances, again, it is dependent upon a very narrow opening in the prepuce, the result either of disease or of a congenital vice. The impediment may also arise from a very long and bulky foreskin, especially if there be at the same time an uncommonly small orifice. In such a case, as I have had occasion to witness more than once, the point of the instrument, instead of entering the meatus, will be very apt to pass between the head of the penis and its preputial investment.

The proper remedy in most of these cases is incision; a narrow

bistoury being introduced, the faulty orifice is enlarged to the requisite extent, after which it is permitted to heal over a bougie, or tent, carefully introduced, and retained until the wished-for object is attained. If the obstacle is occasioned by a long and narrow prepuce, relief is attempted by means of a narrow, slender bivalve speculum, with which the parts are gently but effectually dilated; or, this failing, the redundant structures are slit open, or cleft and ablated, as in the operation of circumcision.

Various contrivances are used for retaining the catheter in the bladder. The one which I usually prefer, consists of a broad waist-

Fig. 69.



band, with two thigh-pieces fastened in front and behind, so as not to interfere with the anus and the scrotum. The instrument having been introduced, is secured by two strips of linen, tape, or oiled silk, by tying the middle of each to the ring of the catheter, and the ends to the vertical bands. Another very good plan is to surround the penis with an ivory, elastic, or linen yoke, and to secure this against the pubes by means of four pieces of tape, carried round the thighs and pelvis. The catheter is then fastened to the ring or yoke in the usual manner. In the annexed drawing (Fig. 69), the instrument is secured to a

piece of linen, passed round the penis, just behind its head. The contrivance, however, is objectionable, on account of its liability to injure the penis, in case of erection.

It is not to be forgotten that a catheter, if allowed to remain too long in the bladder, or if improperly lodged in this organ, may cause very serious, if not fatal injury. Dupuytren, long ago, called attention to this subject, and published cases in support of his opinion. Subsequently, Rognetta¹ met with the same accident on two occasions, which he did not fail to improve for the benefit of the profession. When the instrument is introduced too far, or retained too forcibly, its extremity must necessarily exert undue pressure upon the mucous membrane, and through it upon the other tunics, followed, if it be not speedily moderated, by sloughing and perforation, and eventually by the escape of the urine into the peritoneal cavity, or into the surrounding cellular tissue. In the

¹ *Annales de Thérapeutique*, Juillet, 1843.

former case, the accident is always necessarily fatal, and in the latter it is very apt to become so, either soon after its occurrence, or at an indefinite period. One great fault which most practitioners commit when they have occasion to retain a catheter in the bladder, is that they employ too long a one, and a second, and not less serious one, that they retain it too long in one position. To answer the purpose, the instrument should be at least from an inch to an inch and a half shorter than one used for merely drawing off the urine. These circumstances, although apparently insignificant, are of vast importance in a practical point of view, and should, therefore, always receive due attention.

Catheterism in the Female.—Catheterism in the female is easy enough, unless the urethra happens to be displaced by the weight of the uterus or the pressure of some morbid growth, in which event it is occasionally attended with great difficulty. It should always be performed under cover of the clothes, while the patient lies upon her back, near the edge of the bed. Ocular inspection can be justifiable only when the parts are in a state of great disease, or when the tube has undergone much change in its relative position. The best mode of proceeding is to apply the index finger of the left hand to the upper margin of the orifice of the vagina, which thus serves as a guide to the instrument, which is placed upon its palmar surface, and then moved upwards along the middle line, until its point arrives at the dimple-shaped depression, marking the situation of the mouth of the urethra. The catheter is then passed on with its concavity upwards until it reaches the interior of the bladder; a circumstance which will be indicated by the want of resistance and the flow of the urine. Or, instead of this, the finger may be placed upon the clitoris, just below the commissure of the nymphæ, and the instrument carried from thence downwards along the central line of the vestibule, until its point slips into the tube. When there is much difficulty in performing the operation, in consequence of a change in the direction of the urethra, the ordinary instrument may be conveniently replaced by a gum-elastic one.

The female catheter is made of silver, and is not more than five inches in length. Its vesical extremity is somewhat bent, to adapt it to the shape of the urethra, and is perforated with numerous foramina, instead of having eyelets, as in the male instrument. The other end is provided with two rings, in order to fasten the instrument, when it is necessary to retain it in the bladder, by means of tapes, to a T bandage.

1. *Intrac­tion of the catheter.*—It has long been known that the female catheter will occasionally slip into the bladder, being suddenly and unexpectedly drawn from the fingers of the surgeon. Such accidents are, in fact, not infrequent, and our only surprise is, when we reflect upon the anatomy of the female urethra and the faulty construction of the female catheter, not that they should occur, but that they are not more common than they are found to be. Every instrument of this kind should be provided with small rings, and then, no matter how carelessly it may be introduced, it can never, by any possibility, slip into the bladder.

The urethra and bladder are not the only passages liable to this occurrence. A bougie, for example, used for exploring purposes, has occasionally slipped into the rectum, completely beyond the reach of the finger; a feather, employed for tickling the fauces, has been suddenly sucked into the cesophagus, much to the horror of the operator; and it is a matter of observation that various substances, such as an ear of grass, a pin, needle, or piece of bone, may be drawn into the larynx, at a moment, perhaps, when the patient is making every possible effort to resist their ingress. Nor are such accidents limited to the female sex; it is well known that bits of bougie, straw, wood, leather, and other articles, are often drawn into the male urethra. If the entire catheter never slips into the bladder of the male, it is only because of the greater length and greater curvature of the urethra and of the instrument.

It is not very easy to explain the reason of this occurrence. It is very well known that the female urethra is exceedingly dilatable, and that, like the male urethra, it is endowed with a high degree of contractility; but it is, I think, questionable whether these causes are in themselves sufficient to produce such a result. Doubtless they exert some, indeed, perhaps, an important influence; but it is probable that it would be wholly inadequate if it were not aided by capillary attraction, and by the suction of the bladder. That the organ possesses such a faculty, or a kind of anti-peristaltic action, is indisputable. It is not only found here, but, as has been already seen, in some of the other mucous passages, where it often produces effects as strange and as striking as in the urinary apparatus. Whatever, however, may be the cause of the occurrence, the fact is undeniable, and should be borne in mind by the practitioner whenever he is called upon to perform this important operation.

2. *Difficult extraction of the catheter.*—Although, in general, the female catheter is more easily withdrawn than introduced, yet,

occasionally, the reverse is the case, the operation being executed with great difficulty. A very remarkable instance, in which this occurrence was witnessed, took place, a few years ago, at the Louisville Marine Hospital.

CASE.—The patient, a stout, healthy-looking woman, about thirty years of age, had been laboring under some of the symptoms of stone in the bladder, for which the catheter was introduced by Dr. R. D. Durett, assisted by Dr. John Bartlett. The instrument, an ordinary silver one, with lateral eyelets, entered with perfect facility, and caused neither pain nor inconvenience so long as it was kept at rest; but the moment it was moved about, it produced great distress. The urethra, the vulva, and the vagina, seemed to be perfectly sound, except that they were somewhat relaxed. Whenever an attempt was made to withdraw the catheter, it was found to be so firmly grasped by the parts that it was impossible to remove it without inflicting undue violence. After various means had been ineffectually tried, warm water was injected into the instrument, under the supposition that the resistance was caused by the introduction of a fold of mucous membrane into its eyelets. This also failing, chloroform was next administered, and an attempt made to pass a canula over the catheter, but this produced so much spasm and contraction in the parts, that it was soon obliged to be discontinued. After waiting about two hours, the woman was again put under the influence of chloroform, when the instrument was forcibly extracted, with the effect of slightly lacerating the mucous membrane.

A similar effect, I perceive, has been recently witnessed by two practitioners in Boston. Dr. Putnam,¹ of that city, who has recorded the fact, states that the instrument, used in each of the cases, had lateral slits instead of round apertures. The difficulty experienced in withdrawing the catheter, and the pain inflicted upon the parts in the attempts to do so, are described as having been very great.

The occurrence above mentioned is probably more frequent than is commonly supposed. It is no doubt favored by a relaxed condition of the parts, and appears to be directly dependent upon the introduction of a fold of mucous membrane into the eyelets of the catheter, which seems to be capable, in the female, especially under certain circumstances, of acting on the principle of a suction-pump. To avoid this contingency, as awkward as it is painful, the instrument should be provided with numerous small apertures, which will effectually prevent the intrusion of the lining membrane, however flabby. In the male, such an occurrence is hardly possible, whatever may be the nature of the catheter employed. The proper remedy, in either sex, is the retention of the instrument until the accumulating urine forces the impacted folds into their natural situation. All attempts at forcible extraction should be avoided.

¹ Amer. Journ. Med. Sciences, Oct. 1854, p. 891.

SECTION III.

PUNCTURE OF THE BLADDER.

When the bougie, catheter, and other means have failed to produce relief, the only thing that remains is to puncture the bladder. Fortunately this operation is seldom necessary; thus far, I have not been obliged to perform it, though on two occasions, and two only, I did not know whether I should not be compelled to resort to it. The first case, already alluded to, was that of an old gentleman, upwards of seventy years of age, who had been subject to retention of urine from paralysis of the bladder. In one of these attacks, his physician, who was not very expert in the use of the catheter, made numerous, but fruitless, attempts to draw off the urine with a gum-elastic instrument. Called in soon after, I experienced no difficulty in reaching the organ with a silver catheter, but as its eyelets became immediately closed with blood, not a drop of fluid followed, though the instrument was several times cleaned and reintroduced. As the symptoms were not particularly urgent, it was agreed not to renew the efforts until the next morning, when, if necessary, puncture of the bladder might be had recourse to. On revisiting the patient, catheterism was again performed, and, greatly to my delight, with entire success, upwards of a quart of clear urine passing off. It is obvious, in this case, that the blood which had choked up the instrument the previous evening, had ceased to flow, and that what had entered the bladder had subsided to the bottom of the organ, where it could no longer act obstructingly.

In the other case, the symptoms were more urgent; the patient was a painter, thirty-five years of age, and the retention was occasioned by a tight stricture of the urethra of long standing. For months past, his bladder had never been entirely empty at any one time. Early one evening he came into my office, racked with pain from complete retention, under which he had labored upwards of twenty-four hours; his physiognomy was expressive of deep distress, and he was seized, every few minutes, with violent tenesmus. The bladder was much distended, forming a hard, prominent, and tender tumor, extending nearly as high as the umbilicus. Another practitioner had in vain attempted to pass a gum-elastic catheter; the parts were very sore from the operation, which was persisted in for a long time, and a good deal of blood had escaped

by the urethra. To assure myself of the condition of this canal, I tried to introduce a silver instrument, but failed. Satisfied that the urethra was too irritable to justify any protracted trial of this kind, I requested the patient to go home, and to take at once a grain of morphia, to use tepid drinks, and to bathe his feet in hot mustard water. I also requested him to repeat the anodyne, if necessary, every three hours in half grain doses. Upon visiting him early next morning, I learned that he had spent a tolerably comfortable night, and that, although he had not voided a drop of urine, he was free from pain and spasm. He had taken altogether two grains of morphia. Putting him now under the influence of chloroform, I tried to overcome the obstacle by different sized catheters, but without success, owing to its great length and firmness. Finally, I introduced a urethrotome to divide the stricture, but with hardly any better luck; the instrument advanced only a short distance, and then became permanently arrested. Desisting, for fear of doing harm instead of good, I told the patient I should visit him early in the afternoon, prepared, if he was not relieved, to puncture his bladder. On my return, I was gratified to learn that he had voided, with comparative facility, upwards of a quart of urine, with entire relief of his symptoms. In a week afterwards, I passed a tolerably large-sized catheter into the bladder, much to the surprise and happiness of my patient. His general health, previously not a little impaired, rapidly improved, and for the first time, in several years, he was able to empty his bladder.

The above cases are eminently instructive; they show what may be accomplished by delay, and by the employment of soothing measures. Had I been impatient in the one case, or withheld anodynes in the other, the probability is that the local distress would have been greatly increased, and that it might have become necessary to puncture the bladder.

From what I have seen of retention of urine, I am satisfied that puncture of the bladder is rarely, if ever, necessary. It is only in cases of excessive enlargement of the prostate gland, attended with great tenderness and swelling of the surrounding parts; in laceration of the urethra and infiltration of urine into the scrotum; and in deep-seated, impassable stricture, that the operation should ever be seriously thought of. All other forms of retention will, there is reason to believe, yield to the catheter, aided by time and by soothing measures. The celebrated Desault, indeed, used to maintain that puncture of the bladder was never necessary, on the ground

that there was no case in which a skilful practitioner could not reach this organ with a catheter. During the eight years in which he held the rank of chief surgeon to the Hôtel-Dieu, in Paris, he performed the operation only once, and that was soon after he took charge of the institution. It is true some of his contemporaries have declared that he trusted too implicitly in his dexterity, and that he occasionally made a false passage; but this may have been a mere imputation, raised, without any just foundation, by his detractors. Be this as it may, no one, who has any experience on the subject, can doubt that the operation has often been performed unnecessarily, and that those who have most frequently executed it have been young men, little versed in the use of the catheter and bougie. The late Mr. Liston, whose experience in the treatment of urinary affections must have been very extensive, states that he never punctured the bladder but once.¹

There are four routes by which the bladder may be approached when this operation becomes necessary, namely, the rectum, the perineum, the hypogastric region, and the pubic symphysis. Of these, the first is the one usually preferred, on account of the facility of performing the operation, and its supposed freedom from the danger of urinary infiltration. It is, of course, contra-indicated when there is great enlargement of the prostate gland, or serious disease of the anus, rectum, or bas-fond of the bladder. Under such circumstances, the supra-pubic region is selected.

1. *Rectal Puncture*.—The puncture by the rectum is executed with a curved trocar, about four inches in length, and provided with a canula. The breech of the patient is brought over the edge of the bed, and his legs are supported by two assistants, as in the operation for stone. The surgeon, oiling the index and middle fingers of the left hand, introduces them into the bowel, in contact with its anterior wall; he now takes the instrument in the right hand, retracts the point of the trocar within its sheath, and then places it in the groove formed by the junction of the two fingers in the anus. The only thing that remains to be done is to carry the instrument on until it has fully passed the posterior margin of the prostate, when, by depressing its handle, the point is urged on through the superimposed structures into the interior of the bladder. The want of resistance and a slight escape of urine will indicate that the instrument has reached its destination. By a

¹ Elements of Surgery, p. 507. Philadelphia, 1846.

sort of double movement, the trocar is now withdrawn and the canula pushed farther on into the distended viscus. The urine

Fig. 70.



being evacuated, the canula is either at once removed, or, if there be any serious obstacle along the natural passage, it is retained until this is surmounted. In the latter case, the instrument is secured by a T bandage.

In performing this operation, care is taken not to wound the prostate gland, the deferential ducts, and the seminal vesicles. The first of these organs lies in the middle line, and can usually be easily recognized by the finger; the others are situated higher up, and a little further out, diverging from each other as they proceed upwards, leaving thus a triangular space, the apex of which is below, and the base above. It is this spot which is selected for the operation. Sometimes, especially in very aged persons, the puncture is followed by slight hemorrhage, from wounding the enlarged veins in this situation. It need hardly be added, what is self-evident, that the rectum should always be well cleared out, just before the operation, with an enema.

The operation by the rectum is simple enough; it requires little skill, and is performed in a few seconds. The chief objection to it is, that it is apt to leave a fistulous communication between the bladder and the bowel, permitting a reciprocal discharge of their contents, which, in the case of the former organ, occasionally leads to serious distress, and even to the formation of stone.

2. *Perineal Puncture.*—When the retention is caused by impassable stricture, or by injury of the urethra, the perineum, or the neck of the bladder, followed by infiltration of urine, puncture by

the perineum is to be preferred, in every respect, to any of the other procedures. The operation, however, it must be confessed, is not easy, especially if the relations of the parts are changed by extravasated blood, urine, or inflammatory deposits. On the other hand, it has the advantage of making the opening more in the natural direction of the urine, and affording, at the same time, an opportunity for the removal of the obstruction upon which the retention may immediately depend; in other words, it enables us to accomplish by one operation what we are obliged, if we puncture through the rectum, or the hypogastrium, to do by two.

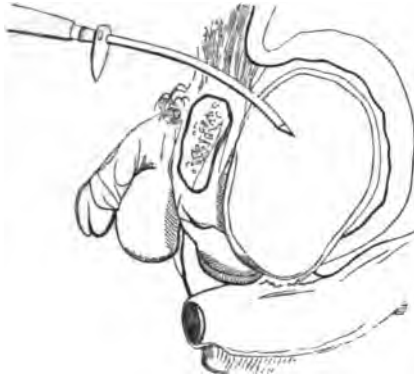
The patient is placed in the position of lithotomy, with the breech projecting slightly over the edge of the table. A moderate-sized catheter is carried down to the seat of the obstruction, where it is firmly held by an assistant, and its point exposed by direct incision, in the raphé of the perineum. The knife is next conveyed backwards through the constricted part, and thence by successive touches on through the posterior portion of the urethra as far as the neck of the bladder. The latter stage of the operation is frequently materially facilitated by the bulging dilatation on the vesical aspect of the stricture. As soon as the bladder is reached, the urine gushes out in a full stream, and the patient is instantly relieved. The operation being completed, the catheter is passed on and retained in the usual manner, care being taken to withdraw it occasionally for the purposes of cleanliness. The bladder being relieved by the removal of the obstructing cause, the wound soon heals, and a permanent cure is the result.

In performing this operation, the surgeon must be on his guard, otherwise he may puncture the rectum, or divide the artery of the bulb; in the former case a troublesome fistule might be the consequence; in the latter, a serious hemorrhage. He should, in fact, employ the same precautions as in perineal lithotomy.

8. *Supra-Pubic Puncture.*—Puncture of the bladder above the pubes has generally been regarded as more objectionable than by any other route, not because of any particular difficulty in the operation, but because of its greater liability, as has been conjectured, to be followed by an escape of urine into the peritoneal cavity and the surrounding cellular substance. Both events are to be dreaded, especially the former, which is almost certainly fatal in from thirty-six to forty-eight hours from its occurrence. The operation is performed in the same manner as supra-pubic lithotomy, only

that the opening is much smaller. The patient being placed on his back, and the skin divested of hair, an incision is made from below upwards, along the median line, from an inch to an inch and a half in length, according to the leanness or obesity of the part, first

Fig. 71.



through the common integuments, and then through the fibrous structure between the pyramidal muscles, down to the cellular tissue which overlays the distended organ. Through this opening the bladder is punctured at its lowest part, by means of a trocar, such as is used in tapping the abdomen, the point of the instrument being inclined obliquely downwards and backwards in the direction of the promontory of the sacrum. Transfixion being completed, the trocar is withdrawn, and the canula gently passed into the bladder, where it is retained by an appropriate bandage, until the obstructing cause necessitating the operation has been removed. The patient in the mean time lies on his side, to promote the escape of the urine. Mr. Abernethy, who gave a decided preference to this mode of puncturing the bladder, often performed the operation with no other apparatus than a pocket scalpel and a lancet; he did not even always, it seems, leave a canula in the organ, the collapse of this sac sometimes preventing him from finding the opening he had made into it. Notwithstanding this, he never witnessed any ill effects from the procedure, such as effusion of urine into the cellular substance, or the peritoneal cavity.¹ No hemorrhage attends the operation.

¹ Willis on Urinary Diseases, p. 210. Philadelphia, 1839.

4. *Inter-Pubic Puncture*.—Puncture of the bladder through the pubic symphysis is of modern invention; and, although it has been performed successfully in several instances, it would, perhaps, be premature to express any opinion respecting its relative and absolute merits. It was first executed in 1838, by Dr. Brander,¹ a surgeon in the East India Company's service, upon a man who had labored under retention of urine insurmountable by the ordinary means. The success of the operation was complete; but the patient died a few weeks afterwards from another malady, and thus afforded an opportunity of inspecting the parts, which were found to be thoroughly cicatrized, and to have experienced no injury whatever from the puncture. Dr. Brander employs a flattened trocar, which he thrusts, without previous division of the integuments, through the centre of the fibro-cartilage, about midway between the vesical orifice of the urethra and the reflected portion of the peritoneum behind the pubic symphysis. The instrument should be at least three inches and a half in length, and should be entered at a right angle with the body, as the patient lies on his back. The canula should be retained in the usual manner, or be immediately withdrawn according to the exigencies of the case.

The inter-pubic operation, as it may be denominated from the parts involved, has met with several warm advocates in England, and the probability is that we shall soon be able to pronounce definitely concerning its merits. The only instance, so far as I know, in which it has been performed in this country, occurred in the practice of Dr. Leasure,² of Newcastle, Pennsylvania. The case was one of obstinate stricture and enlarged prostate, in a man seventy-two years of age, who, after much suffering from previous disease, finally recovered. The operation which is perfectly simple, does not involve any injury to the peritoneum, and is entirely free from the danger of urinary infiltration; no such effects, at all events, have yet followed it in any instance. The passage of the instrument might be impeded by the ossific union of the pubic bones; but this occurs chiefly in advanced life, and therefore constitutes no valid objection to the operation.

Statistics.—Mons. Mondière has given, in the *Revue Médicale* for April, 1841, the following interesting statistics of ninety-two cases of puncture of the bladder:—

¹ Braithwaite's Retrospect, Part xxvi. p. 251. New York, 1853.

² American Journal of the Med. Sciences, April, 1854, p. 403.

Puncture.	No. Cases.	Success.	Fistule.	Infiltration.	Abscess.	Hemorrhage.	Death.
Perineal,	9	6	1	0	0	1	1
Recto-vesical,	28	19	3	3	1	0	2
Supra-pubic,	55	49	0	0	0	0	6
Total,	92	74	4	3	1	1	9 ¹

From this table it would seem that the recto-vesical operation is less fatal than any of the others, but that it is more liable to be followed by fistule, infiltration, and abscess. As respects its mortality, the perineal and supra-pubic punctures are about on a par. The proportion of fatal cases to the number of recoveries, is remarkably small.

Edward Cock,² Esq., Surgeon to Guy's Hospital, London, has recently published the particulars of forty cases of puncture of the bladder through the rectum, in all of which, save two, the result, it would seem, was perfectly successful in effecting the object for which it was adopted. These cases extend over a considerable number of years, and, although they had all come under his own observation, he himself performed the operation only twenty-four times, the other cases having been furnished by his friends and colleagues, Messrs. Cooper, Birkall, Poland, and others. Nearly all the patients labored under obstinate stricture of the urethra, with urgent symptoms from retention of urine at the time of the puncture. None of them, so far as Mr. Cock could judge, experienced any injury or ill consequence from the operation, while many were restored much more rapidly, and with a less amount of suffering, than they could have been by any other procedure. In the two unsuccessful cases, Mr. Cock failed, in one, in his attempt to reach the cavity of the bladder, and in the other he had reason to believe that an injury was inflicted, which, although the patient was already in a hopeless condition, probably tended to hasten the fatal event.

In addition to the above cases, Mr. Cock refers to eight others in which the bladder was punctured through the rectum by his colleague, Mr. Hilton. In seven of the cases the retention of the urine, necessitating the operation, was occasioned by stricture of the urethra, and was so urgent as to demand immediate relief. "No important difficulty or untoward circumstance occurred in any of these at the time of the operation, nor was it followed in any instance, to

¹ Amer. Journ. Med. Sciences, vol. iii. 495.

² Medico-Chirurgical Transactions of London, vol. xxxv. p. 182, 1852. London Medical Times and Gazette, vol. xxiv. p. 454, 1852.

my knowledge, by any peritonitis. One patient died some time after the operation, and I found at the *post-mortem* examination that the trocar had, in part, divided the left vas deferens, or ejaculatory duct, close to the prostate. I do not think that this circumstance contributed anything to the fatal issue of the case."¹

I recollect a singular instance of supra-pubic paracentesis of the bladder, in which the puncture, after having been perfectly healed, reopened after a lapse of fourteen years. The patient, Mr. Levan Lawrence, of the vicinity of this city, was a farmer by occupation, and was upwards of seventy-two years of age at the time of his death. In the autumn of 1831, while on a visit to the interior of Indiana, he was seized with retention of urine, for which a physician of Terre Haute performed the operation in question, though it was doubtless unnecessary. For several months he wore a tube in the wound; upon laying aside which the part speedily cicatrized, and so continued until about four weeks before he died, when, all at once, it reopened, the skin having been the seat, for several days, of erysipelatous inflammation. Urine afterwards continued to discharge through the abnormal passage up to the time of the patient's dissolution, the immediate cause of which was constitutional exhaustion.

¹ One would suppose, from reading Mr. Cock's account of his cases, that he had a peculiar penchant for this operation, which he has undoubtedly performed more frequently than any other surgeon that has ever lived. It is not the object of this work to criticize the practice of any one, but I must be permitted, with all deference, to enter my caveat against what appears to me to be such an indiscriminate and useless procedure. One of two things, with reference to this operation, is certain: either Mr. Cock is wrong, and the rest of the profession is right, or the converse of this statement is true, which, however, hardly any one will believe. The practice of that gentleman should not be considered as a fair exponent of the experience of the surgeons of Great Britain. During a discussion of Mr. Cock's paper before the Royal Medical and Chirurgical Society of London, in 1852, Mr. Charles Hawkins remarked that he had never heard a communication read before that body which had astonished him more, or taken him more by surprise. "He had been acquainted with St. George's Hospital for more than twenty years, and he could not learn that the operation had ever been performed there during all that period, or even for a much longer time. He knew that those in the most extensive practice at his end of the town had found it necessary to have recourse to it only about half a dozen times in a period of forty years."—*Med. Times and Gazette*, vol. iv. p. 453. New Series, 1852.

CHAPTER XVI.

INCONTINENCE OF URINE.

INCONTINENCE of urine, the reverse of retention, with which it is often associated, may occur at any period of life, and may be partial or complete, temporary or permanent. It is in general a very distressing affection, for the constant discharge not only keeps the clothes wet, but it excoriates the thighs and genital organs, and thus leads to much suffering. The smell is also extremely offensive. It may be excited by a great variety of circumstances, the most prominent of which, however, are referable to external injury, or to inflammation, spasm, paralysis, or morbid sensibility of the bladder, or of this organ and the urethra. The water may pass off as fast as it is secreted, or it may be retained for a time, and then either dribble away, or be discharged in a full stream.

I. The best example of incontinence from *external injury* is afforded in lithotomy. Of the frequency of this occurrence after this operation in the male, no estimate can be formed, as we have no correct data. There is reason, however, to believe that it is rare. In this form of the affection, the incontinence is generally most distressing in the day, while the person is in the erect posture. In the only instance of the kind that has come under my notice, the patient, a boy nine years of age, has the most perfect control over his water at night, or during recumbency; but as soon as he rises or walks about, it begins to dribble off, even when there is no distension of the bladder, and so continues until he lies down. In this variety of incontinence, there is evidently a partial loss of power of the muscular fibres at the neck of the bladder, united with excessive morbid irritability of the mucous membrane. A kick, blow, or fall upon the perineum is occasionally followed by the same result. In the female, the operation of lithotomy is extremely liable to be succeeded by incontinence.

Incontinence from external injury often disappears spontaneously; and, on the other hand, it is occasionally incurable. The treatment must be conducted on general principles. In the early stages, much

benefit will frequently be derived from leeches to the perineum, rest in the horizontal posture, light diet, and gentle purgatives, along with the liberal use of bicarbonate of soda and decoction of uva ursi. Where there is much morbid irritability of the bladder, direct medication may be resorted to, by cauterization, or astringent and anodyne injections. Compression of the perineum with a spring truss will also be worthy of a trial.

II. Incontinence from *inflammation* may depend upon various causes, as external violence, the extension of gonorrhoea, stone in the bladder, and stricture of the urethra. The escape is usually partial, and is almost constantly associated with spasm. The treatment consists in removing the exciting cause, which is frequently of itself sufficient to effect a cure, and in the employment of the lancet, the hip-bath, antispasmodics, and anodyne injections. The catheter often affords instant relief.

III. *Paralysis of the bladder*, or of this viscus and the urethra, however induced, is a frequent cause of incontinence. The loss of power may be the result of direct injury, as a severe contusion of the abdomen, pelvis, or perineum, or it may be the consequence of some disorder of the sacro-lumbar nerves. In the latter months of pregnancy, as well as during protracted parturition, the neck of the bladder is sometimes paralyzed by the pressure of the child's head, and the incontinence thus produced may last a long time. This affection is occasionally met with in fever, in concussion of the brain, in injury of the spinal marrow, in hysteria, epilepsy, and other nervous diseases. Old men who have led irregular and dissolute lives, and who have labored long under disease of the urinary passages, are very prone to suffer from incontinence of urine.

In the treatment of incontinence from paralysis, the incontinence of retention, as I have elsewhere denominated it, our remedies must be addressed chiefly to the invigoration of the nervous system. For this purpose, after having cleared out the bowels and corrected the secretions, the patient is put on the use of strychnine, either alone or in union with some mild tonic medicine, such as the extract of gentian and sulphate of iron. The dose of strychnine should not exceed, at first, the sixteenth of a grain, three times a day, but it may be gradually increased to the twelfth, or even the tenth of a grain. Advantage will be derived from combining with it a small quantity of powdered cantharides, especially if the latter article be carried to the extent of slight strangury. The muriated tincture of iron is often a valuable remedy. The diet must be light but nutritious, and

the patient should make frequent use of the cold shower-bath, followed by dry frictions. Exercise in the open air is also attended to. Counter-irritation is kept up in the sacro-lumbar region, either by a succession of blisters, tartar emetic ointment, the moxa, or, in obstinate cases, even by the actual cautery. When the loss of tone has been induced by long continued pressure on the bladder, as, for instance, in severe labor, little benefit is to be expected from any mode of treatment. Such cases usually either get well of their own accord, or they persist in spite of our best directed efforts to relieve them.

IV. Incontinence may arise from a *morbid irritability* of the neck of the bladder, or of the entire organ, excited by the acid character of the urine, or by sympathy with the kidney, rectum, anus, vagina or uterus. In the early months of pregnancy, the patient is often tormented with a constant desire to urinate, and if the inclination be not instantly gratified, the water flows off involuntarily. Worms in the lower bowel, hemorrhoidal tumors, and fissure of the anus are often attended with incontinence. Masturbation, or inordinate sexual indulgence, by establishing a morbid sensibility of the mucous membrane of the neck of the bladder, or commencement of the urethra, may be followed by the same result. In most of these instances, the incontinence is incomplete.

To this form of incontinence obviously belongs that variety of the disease which occurs in *young subjects*. It is most common in children before the period of puberty, and often begins at a very early age. The discharge, which may take place twice or even thrice during the night, is sometimes effected under the influence of the will or a dream, but in general it is strictly involuntary. When it becomes habitual, as, in fact it usually does, it may last for years, and be even prolonged into advanced life, though in most cases it gradually disappears on the approach of adolescence. It is promoted by the use of fluids, by exposure to cold, and by sleeping on the back, a posture which is favorable to the accumulation of urine in the morbidly sensitive portion of the bladder.

The pathology of this affection consists, as has been already stated, in an exaltation of the natural sensibility of the mucous membrane of the neck of the bladder, unaccompanied, in many cases, by any appreciable change of structure. Sometimes there is slight thickening of the part, and occasionally the affected surface is somewhat inflamed. In protracted cases, there may be hypertrophy of the prostate gland, though never to any considerable extent.

The sphincter of the bladder is easily relaxed, and yields to the most trifling impulse: hence the urine often flows off even when there is no fulness or distension of the organ.

In the *treatment* of this form of incontinence, particular inquiry should be made into the nature of the exciting cause, the removal of which is of paramount importance. The condition of the urine is examined, disease of the neighboring structures is corrected, and the patient's habits are attended to. Where there is no tangible cause, the case must be managed on general principles. In that variety of the affection which is met with in boys and girls, the cure may be greatly expedited by proper attention to the diet, which should always be bland and unirritant. Late suppers are avoided, and the patient must abstain entirely from drinks for several hours before going to bed. During the night, he is to be waked two or three times for the purpose of emptying his bladder, and this practice is to be persisted in for weeks and even months, until the disagreeable habit is broken up. During all this time, as well as, indeed, for a long period afterwards, the child should lie upon his side, to prevent the urine from coming in contact with, and irritating the neck of the bladder. The internal remedies from which I have derived most benefit, in the treatment of this affection, are strychnine and cantharides, given three times a day, in the proportion of the twelfth, sixteenth, or twentieth of a grain of the former to the eighth, twelfth or sixteenth of a grain of the latter, according to the age of the subject. A minute portion of opium forms a valuable addition; and, in atonic cases, I often combine with these articles some of the preparations of iron. When the strychnine disagrees, or fails to answer the purpose, we may substitute the extract of *nuxvomica*. In either case, it is important to watch the effects of the remedy. I have great confidence in the use of cantharides in this affection, and have known it to afford relief when everything else seemed to prove unavailing. I prefer the powder to the tincture, and occasionally continue the exhibition of it until slight strangury is induced. During the last few years, benzoic acid has been highly recommended as possessing a controlling influence in cases of this kind; but the few trials which I have made of it have disappointed my expectations. When the morbid sensibility of the bladder is connected with inflammation, the balsam of *copaiba*, in doses of from ten to fifteen drops every six or eight hours, is sometimes highly beneficial. In large doses, it is sure to irritate the stomach, and to disagree with the urinary organs. In this variety of the

affection, a full anodyne at night, especially in the form of Dover's powder, often exerts a happy effect in controlling the discharge. As auxiliary measures, the cold shower-bath should be used once or twice a day, or cold water poured from a considerable height upon the lower portion of the spine, and blisters applied to the sacro-lumbar region, the perineum, or the inside of the thighs. In obstinate cases, the neck of the bladder is cauterized, as in spermatorrhœa, but much more mildly, on account of the more tender age of the patient. In the female, the application is made to the orifice of the urethra.¹

Very recently belladonna has been recommended in the treatment of this variety of incontinence of urine by Dr. Trousseau and Dr. Blanche, of Paris.² The latter, who is physician to the Hôpital des Enfants, has published the particulars of two very obstinate cases, in patients of fifteen and eighteen years of age, in which a great variety of remedies, as sulphurous baths, cold and astringent applications, tonics, tannin, spurred rye, and nux vomica, had all failed, and in which ultimately belladonna was exhibited with complete success. The best mode of administering the medicine is in the form of extract, in doses varying from the sixteenth to the eighth of a grain, according to the age of the patient, every night at bedtime. A steady persistence of the treatment for several months is necessary to insure a cure.

Sometimes great benefit results from the use of anodyne enemata and suppositories in this form of incontinence. They almost always afford temporary amelioration, but occasionally they promptly remove the disease after a failure of the more common means. Suppositories are, on the whole, more efficacious than injections, and they are also more liable to be retained; they therefore merit a decided preference.

The application of *pressure* to the urethra, gentle but steady, and gradually increased, has sometimes been found beneficial in removing this complaint. Many years ago, the attention of the profession was called to the subject by Mr. Hyslop, of England, in a short paper in the sixth volume of the Medico-Chirurgical Society of

¹ Mons. Petrequin states (Johnson's *Medico-Chirurgical Review*, vol. xxxi. p. 218) that he has treated successfully many cases of nocturnal incontinence of urine in children, with the tincture of nux vomica, as an embrocation to the loins and perineum. Another method, to which he has sometimes recourse, consists in the introduction into the rectum of a seton, or skein of thread, well covered with a cerate of this substance.

² Amer. Journ. Med. Scien. N. S. vol. xvii. 187.

London. He illustrates the good effects of the treatment by the details of a case, which was promptly relieved in this manner. The patient was a youth, thirteen years of age, for the last nine of which he had never passed a single day or night without several involuntary discharges of his urine. Tonics, cold bathing, opiates and blisters, had all been tried to no purpose. When Mr. Hyslop first saw him, he was in wretched health, with great depression of spirits, and severe excoriation of the genital organs and neighboring parts. The pressure was made with a bougie, cut off several inches from its extremity, and large enough to distend the urethra. The instrument was then placed along the under surface of the penis, on the outside of and parallel with the excretory canal, with the point projecting a short distance beyond the glans, and confined with adhesive strips, extending as far back as the scrotum. In this manner the sides of the urethra were so completely approximated that no space was left by which the urine could escape. Whenever the patient was obliged to pass his water, which was, at first, every four or five hours, the pressure was removed, and immediately after reapplied. In this way the treatment was continued, without any unpleasant symptoms, for three days, at the expiration of which the affection had entirely disappeared.

When the incontinence depends upon morbid sensibility of the urethra and neck of the bladder, such a proceeding is worthy of trial, especially where the more ordinary means have failed. When the tender surface is situated behind the scrotum, the probability is that the pressure of a truss, resting upon the perineum, might be serviceable. The pad should be placed directly over the middle line, and should bear so firmly upon the parts as to occlude the urethra.

In all cases of nocturnal incontinence, the practitioner must endeavor to secure the co-operation of the patient. The unhappy effects arising from a persistence of the habit must be fully pointed out; the child must be reasoned with, and even threatened with chastisement; the fear of punishment puts him on the alert, and induces him to keep a constant watch over the bladder. The patient, of course, is not beaten; nor does any sensible man ever think, at the present day, of tying up the penis; such a proceeding would be not less cruel than absurd.

Of the folly and danger of the employment of artificial means for restraining nocturnal incontinence of urine, the following cases serve as interesting and valuable examples.

CASE 1.—A child, nine years of age, had been long troubled with this complaint, and never passed a night without wetting his bed. His chagrin was excessive, and as everything had been tried in vain for his relief, he was advised to tie a piece of packthread round the penis. During the night the pain awoke him, but ashamed to complain, he permitted the ligature to remain on until morning, by which time it had become intolerable. J. L. Petit, the illustrious secretary of the Academy of Surgery, being called to his aid, found that the skin of one-half of the member, below the seat of the constriction, had fallen into gangrene. Upon the removal of the thread, the urine flowed with some difficulty, but by degrees three half pints were discharged; the bladder, however, had lost so much of its contractile power that it was unable to expel the whole of its contents. After making two deep and parallel incisions, he divided the prepuce, which was affected with congenital phymosis, and applied the dressings in such a manner as to leave an opening for the escape of the urine. Suppuration was soon established, a few flaps of skin separated, the sore assumed a healthy aspect, and in twenty days the cure was completed. The most remarkable circumstance of this case was, that the patient ceased from the moment of the accident to wet his bed, and so continued ever afterwards.

CASE 2.—A lad, aged eight years, passed a brass curtain-ring over his penis, to prevent incontinence of urine during the night, and thereby escape chastisement, to which he had been frequently subjected. Great swelling soon occurred round the foreign body, which he was unable to remove, and he experienced much pain and difficulty in voiding his urine. The integuments under the ring gradually ulcerated, and, when the swelling subsided, the ring seemed to be concealed in the substance of the penis. Cicatrization took place, and all uneasiness soon ceased. The penis performed well all that was required of it; the urine passed easily, and after a while the boy, now a man, became the father of a family. When between fifty and sixty years of age, he applied to Mr. Liston, the narrator of the case. For some years previously difficulty in making water had been coming on, and frequent desire to pass it in the night-time rendered him very uncomfortable. He was obliged to have a vessel constantly in bed, and was generally disturbed every half hour. The penis had become very unserviceable, and he was now anxious to have the ring removed. A broad, hard substance was felt surrounding the penis, close to the pubic symphysis; an incision was made into the urethra at that part, and a calculus easily extracted. The uneasy symptoms quickly disappeared, and the patient recovered with a small fistule, for which he refused to be treated. The calculus was of the size of a prune, crescentic in shape, and composed of uric acid, with a crust of ammoniaco-magnesian phosphate. A section of it disclosed about two-thirds of the brass curtain-ring, firmly impacted in the centre, and partially decomposed.

V. Incontinence, like retention of urine, is occasionally of a *periodical* nature, resembling, in this respect, an attack of intermittent fever, only that it is not preceded by chills, or followed by sweats. One of the best marked examples of this variety of the affection of which I have any knowledge, came under my observation in December, 1851, in a young man, twenty-two years of age, a bar-keeper in a coffee-house in this city, of sanguine temperament, and perfectly regular habits. After having retired one evening, in

¹ Liston's Elements of Surgery, p. 509. Phil. 1846.

his usual health, he was seized, while asleep, with a discharge of urine, which caused him to wet his bed, and which returned afterwards, with great regularity, every night, from one to three o'clock. The discharge occurred sometimes once, sometimes twice, and occasionally even thrice, during the night, waking him generally each time. In the day he never had any difficulty, either in the recumbent or the erect posture. The urine appeared to be normal both in quantity and quality. The affection had existed for a fortnight, when he applied to me for relief. He had never suffered in this way before, and he could assign no reason for the present attack. His general health had all along been good, with the exception of slight derangement of the digestive organs; the appetite was excellent, and the bowels were perfectly regular. He was entirely free from pain, but complained occasionally of a sense of weight and uneasiness at the neck of the bladder.

As his tongue was quite clean, I requested him merely to regulate his diet, to avoid all stimulating articles of food, and to take, every eight hours, seven grains of quinia, in union with the eighth of a grain of sulphate of morphia. He came back to me in four days, declaring that he was perfectly relieved, and that he had not had an attack of his complaint since his first visit. To guard against relapse, he was directed to continue the treatment for several days longer, when he again reported himself well, nor did he have any other attack afterwards.

A very instructive case of this form of incontinence, associated with inflammation of the neck of the bladder, and unequivocally dependent upon a miasmatic cause, is related by Dr. William M. Boling, a distinguished practitioner of Montgomery, Alabama, in the *American Journal of the Medical Sciences*, for July, 1844.

CASE.—The patient, a married lady, eighteen years of age, and six months advanced in pregnancy, had a slight chill on the 4th of October, which was followed, on the night of the 6th, by excruciating pain in the urethra and neck of the bladder, attended with incontinence of urine, which dribbled away in drops. There was a sense of scalding and soreness in the vulva, with deep-seated pain in the hypogastrium, and considerable constitutional disturbance, as indicated by a full and hard pulse, headache, thirst, and augmented heat of the skin. The urine deposited a white, pulverulent sediment, mixed with ropy mucus. For the relief of these symptoms, the lady was bled to the amount of twelve ounces, after which she took a warm bath, and morphia with blue mass. The next morning, there was less pain in the bladder, and she was able to retain her urine, but in the evening, all the former distress returned. The same means, except the bleeding, were now repeated, followed, towards morning, by a saline cathartic. The bowels being evacuated, the patient was put on the use of quinia, and from that time on, the vesical symptoms gradually subsided, and there was no further recurrence of the incontinence of urine.

Finally, when the incontinence is irremediable, the patient should wear a *urinal*, to prevent the fluid from soiling his clothes, and thus rendering him not only disagreeable to himself, but offensive to his neighbors. The best contrivance for this purpose is a gum-elastic bottle, shaped somewhat like a Florence flask, and capable of holding about twelve ounces. This should be closely adapted to the parts, and changed as often as circumstances may require. A larger bottle might be used at night to obviate the necessity of rising; and such an expedient would also enable the sufferer to observe a greater amount of cleanliness. The subjoined cuts will convey a better idea of the apparatus than any description, however elaborate. Fig. 72 represents the male, and Fig. 73 the female

Fig. 72.

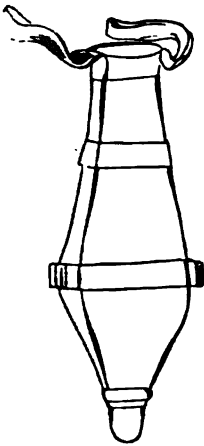
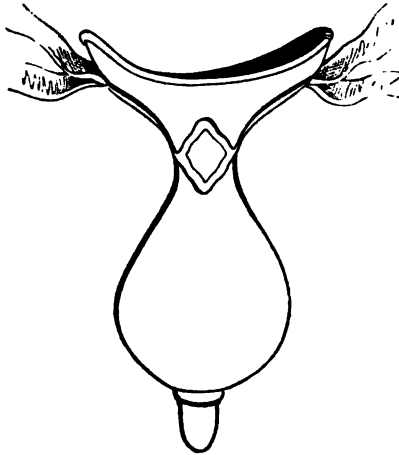


Fig. 73.



urinal. The articles are of French manufacture, but they are for sale by Mr. Tiemann, cutler, Chatham Street, New York. Each instrument is furnished at its inferior extremity with a screw, for the purpose of evacuating the urine after it has accumulated to some extent in the artificial reservoir. The interior should be frequently washed for the sake of cleanliness, and every patient should be provided with an extra vessel, so that he may not suffer any inconvenience in case of accident.

CHAPTER XVII.

HERNIA OF THE BLADDER.

THE bladder, like the other abdominal viscera, is liable to protrude from the pelvic cavity, constituting what is denominated a cystocele. The accident, although uncommon, is of great practical interest, and therefore requires some notice in this place. It is said to have been first described by T. D. Sala, since whose time it has been portrayed with so much accuracy by different pathologists and surgeons as to render it impossible to add anything new to its history.

The protrusion may take place in different regions, the principal of which are the inguinal, the femoral, and the vaginal, the latter of which is its most common seat. Pipelet relates an instance in which it occurred in the perineum; and, in the fourth volume of the *Edinburgh Medical and Surgical Journal*, mention is made of a cystic hernia which projected between the elevator muscle of the anus and the internal obturator muscle into the pudendum. Verdier saw a case where the bladder with the urachus and umbilical artery was drawn down into the scrotum. An instance of protrusion of this organ through a wound, caused by a bullock's horn, is recorded by Larrey. A distended bladder has occasionally descended before the head of the child in labor; and an instance is recorded by Merriman, where a tumor thus formed was actually opened under the supposition that it was a hydrocephalus.

A hernia of this description is sometimes complicated with a bubonocoele, or hernia of the groin, which it may either precede or follow. In those enormous abdominal ruptures, in which a large mass of the intestinal tube is protruded, the bladder occasionally forms a constituent part of the tumor. On the other hand, the bladder sometimes descends first, and thus paves the way, as it were, for the escape of the bowel. A very interesting fact, in relation to one of the subjects of the present treatise, is the occasional coexistence of stone in the protruded organ. Of this occurrence, quite a number of examples are mentioned by authors. One of the

most interesting, in a practical point of view, is that recorded by Sala, in which the patient had all the symptoms of stone, though none could be felt by the sound. After death, the foreign body was found in the bladder, which was contained in the groin. In a case given by Petit, the calculi, which were several in number, were discharged by the urethra. Hartmann has recorded an instance in which a pudendal cystocele contained a stone weighing three ounces.

Hernia of the bladder occurs in both sexes, and at different periods of life. A case is given by Pott of a boy of thirteen. The occurrence, however, is most common in elderly male subjects who have been repeatedly afflicted with retention of urine. Of the exciting causes nothing special is known; but the probability is that they do not differ from those of hernia in general. In women, the affection, particularly that form of it known as vaginal cystocele, has been noticed as an effect of dropsy and pregnancy. In children, it has sometimes been caused by the irritation of stone.

The cystic hernia is destitute of a proper peritoneal sac. As the bladder, in the natural state, is covered only partially by serous membrane, it is evident that, as it passes out of the abdomen, it must lie exterior to this investment. The only exception to this rule is where the rupture is of long standing, or the tumor is of great bulk, in which case the fundus of the bladder may drag the peritoneum down into the scrotum, so as to form a hernial sac, into which a portion of bowel or omentum may afterwards protrude. The swelling is always formed, in great measure, by the superior portion of the viscus, and is generally of small size, though occasionally it has been known to attain the magnitude of a fist or of a goose's egg. When the disease is complicated with bubonocoele, the intestinal hernia invariably lies in front of the cystic.

In a case observed by Mr. W. J. Clement,¹ of England, the whole bladder had passed out through the left abdominal ring down into the scrotum, forming an enormous tumor which occupied both the pubic and inguinal regions, and was nearly fifteen inches in length by twenty-nine in circumference. The penis was completely buried beneath the integuments, and the urine was discharged through an opening resembling the navel. The canal through which the protrusion had taken place was traversed by a portion of the colon, and was sufficiently capacious to admit the entire hand. The sac,

¹ *Observations in Surgery and Pathology*, p. 145. London, 1832.

formed by the bladder, looked like an enormous hydrocele, and contained two quarts of fetid urine, which escaped during the dissection by the rupture of a part which had become red and inflamed before death. The abdomen presented no evidence of acute inflammation, and there was nothing remarkable in the pelvis, excepting the want of the urinary bladder. The patient, a very corpulent man, about sixty years of age, had suffered for twenty-five years, and had not been able for a long time to make water without first raising the tumor towards the belly, and then rolling it about, when the urine would flow in a full stream, though only in small quantity. The general health had been tolerably good, but he had experienced repeated attacks of constipation and of slight hemiplegia, and the swelling had produced no alarming symptoms until about a fortnight before his death, when obstinate intestinal obstruction came on, with paralysis of the left side, and retention of urine. Various means were employed for his relief, but the pain and vesical difficulty gradually increased, and he sank into a state of delirium, from which he never recovered.

A cystocele is a soft, elastic, and fluctuating tumor, which varies in its size according to the amount of urine contained in the protruded part. When the bladder is full, the tumor is large and tense, but very small, or almost effaced, when the viscus is empty. It is free from pain, increases from above downwards, and attains its volume in a slow and gradual manner. When examined in a dark room, with the aid of a candle, it appears translucent, very much like a hydrocele. If the tumor be compressed, it diminishes in size, and the patient experiences an inclination to void his urine. If reducible, it returns during recumbency, but reappears soon after the resumption of the erect posture. If, on the contrary, the parts are adherent, or if the muscular coat of the bladder is paralyzed, the patient cannot expel his urine from the tumor unless he resorts to compression.

The *diagnosis* of cystocele is a matter of importance, as a tumor of this kind has occasionally been cut into by mistake. This accident occurred to the celebrated Pott, of England. The most decisive symptom is the change which the swelling undergoes in its volume during micturition. As the water flows off, the tumor decreases, or entirely disappears, to recur again, however, as soon as the urine has reaccumulated to some extent in the protruded part. A cystocele has not the doughy, inelastic feel of an omental hernia, nor the soft gaseous feel of an intestinal one, nor does it

return with that peculiar gurgling noise which accompanies the ascent of the latter. When the bladder is contained in the scrotum, the disease might be mistaken for a hydrocele, though such an error could hardly be committed except by a careless, superficial observer.

The *treatment* of cystocele, seated in the groin or scrotum, does not differ from that of intestinal hernia. When the tumor is reducible, it should be kept up by means of an appropriate truss; but when the viscus has contracted adhesions, and no longer admits of reposition, the patient must be contented with a suspensory bag. The urine which accumulates in the lower part of the sac must be discharged by raising and compressing the tumor during micturition. If retention should take place, and relief cannot be afforded by the catheter, the part should be punctured. If calculi collect, and become a source of great suffering, they may be extracted by incision of the sac.¹ Such an operation was successfully performed by Pott.

In *vaginal* cystocele, of which I have seen several examples, the swelling is of a globular shape, free from pain, and of a soft elastic feel, imparting, on handling, the sensation of fluid contents. Situated at the anterior portion of the vagina, the tumor varies in volume from that of a pigeon's egg up to that of a fist, and is either contained within the tube, or protruded beyond the vulva. In the more aggravated forms of the complaint, the entire cylinder of the tube is involved. For the production of this affection a certain degree of relaxation of the walls of the vagina is necessary, and hence it is most common in females who have borne many children, or who have suffered a long time under leucorrhœa. When the tumor protrudes beyond the vulva, it forms a translucent sac, not unlike a serous cyst, or the amniotic bag. The diagnosis is determined, first, by the facility with which the tumor is reduced; secondly, by the absence of any opening in its walls; thirdly, by the want of displacement of the uterus; and fourthly, by the fact that the volume of the swelling is greatly diminished by catheterism. An instance occurred not long ago in France,² in which a protrusion of this kind was mistaken by a medical practitioner for a prolapse of the uterus. A pessary was actually forced through the vagina into the bladder, where it was allowed to remain five

¹ S. Cooper's *First Lines of Surgery*, by Dr. Parker, vol. ii. p. 218.

² *Annales des Thérapeutiques*, Fev. 1848, p. 425.

months, causing the most violent suffering. It was finally extracted through the fistule, but not without the greatest difficulty and pain. Such an error is as inexcusable as it is disgraceful.

For the relief of ordinary vaginal cystocele, the principal remedies are, the frequent withdrawal of the urine, injections of cold astringent lotions into the vagina, the use of a well-constructed pessary, and rest in the recumbent posture. The general health must be improved by laxatives, light but nourishing diet, and the use of chalybeate tonics.

A vaginal cystocele occasionally interferes with parturition, by impeding the passage of the child's head. The bladder is pushed down by the distended uterus below the arch of the pubes, forming a tumor in the anterior portion of the vagina, which feels like a tense bag, of a globular, ovoidal, or cushion-like shape, and the volume of which ranges, according to the quantity of urine present, between an orange and a large fist. In some instances the tumor hangs out through the vulva, while in others it lies partly within and partly without the vagina. The protrusion is most apt to take place during the early stages of labor, before the child's head has reached the pelvic cavity, and appears to be produced by the pressure which the descending head exerts upon the upper portion of the distended bladder. As the labor advances, the displaced organ is still further depressed by the contraction of the uterus; and thus the case progresses until the vaginal passage is sometimes totally occluded.

The symptoms which attend the affection, in this event, are variable. In ordinary cases, there is merely an irritable condition of the bladder, with, perhaps, a frequent desire to urinate, and some difficulty in evacuating the water. Occasionally the patient is harassed with retention, or at one time with retention and at another with incontinence. The recumbent posture usually ameliorates while the erect aggravates her suffering. She also generally complains of dragging pains in the pelvic region, and of uneasiness in the groin and perineum. When the prolapse takes place during labor, the suffering is generally more severe; the desire to urinate is much more urgent and frequent; the patient is wholly unable to pass water; the tumor is very tense and painful; and there is a most distressing dragging sensation in the hypogastrium, the parts feeling as if they wanted to come away, but could not.

The diagnosis of a vaginal cystocele, complicating parturition, is generally sufficiently easy; nevertheless, we occasionally read of

cases in which, for the want of proper discrimination, such a tumor has been punctured. Chaussier met with an instance in which a large swelling of this kind was mistaken for the head of a child. The patient was in labor, and her attendant was on the point of opening the tumor for the purpose of extracting the child, when the celebrated Frenchman arrived and recognized the disease. A case is mentioned by Dr. Hamilton where the prolapsed bladder was actually punctured, under the supposition that it was nothing but the bag of the ovum; and Merriman, as already intimated, records one where a similar blunder was committed under the belief that the swelling was a hydrocephalic head. These examples, the number of which might be easily multiplied, are sufficient to show how important it is for the practitioner to have a correct knowledge of this disease. The opening of a prolapsed bladder might readily produce a bad fistule, and even destructive inflammation.

The characteristic signs of the affection are, first, the sudden development of the tumor; secondly, the peculiarity of its situation at the anterior wall of the vagina; thirdly, its soft and fluctuating consistence; and fourthly, its diminution, or effacement under compression, and the desire which the patient feels, when it is thus acted upon, to make water. During parturition, the tension of the swelling is increased during the contraction of the uterus and lessened during its relaxation. Moreover, by introducing the catheter, which, however, is sometimes very difficult, the bladder may usually be completely emptied, and, consequently, the bag made to disappear.

The treatment of this form of cystocele consists in drawing off the urine by means of a male catheter, with the point directed downwards towards the base of the tumor. The common female catheter is not sufficiently curved, and is, therefore, unsuited to such a contingency. The patient lying on her back, with the limbs elevated and separated from each other, the operation is performed during the repose of the womb, lest the pressure of the child's head against the extremity of the instrument should occasion mischief. If catheterism be found impracticable, as it sometimes is, under such circumstances, the accoucheur, introducing several of his fingers into the vagina, waits until the uterine pains go off, and then, pressing against the inferior surface of the tumor, he pushes it upwards behind the pubic bones, and, consequently, towards the superior strait of the pelvis. Held in this situation until there is a return of the pains, there will be no probability of a reproduction of the swelling.

CHAPTER XVIII.

INVERSION OF THE BLADDER AND PROTRUSION
OF THE ORGAN AT THE URETHRA.

THE affection which it is proposed to describe under this caption is very different from extroversion, the history of which was given in a preceding chapter. The latter, as has been seen, consists essentially in a congenital malformation, attended with a deficiency of the anterior wall of the bladder, the ureters terminating upon the outer surface of the abdomen; the former, on the contrary, is a genuine inversion of the organ, or of its lining membrane, accompanied by a protrusion of the displaced part at the orifice of the urethra. The affection, which is probably less rare than is generally supposed, is exclusively confined to the female sex; the great length, peculiar form, and great narrowness of the urethra in the male not admitting of its occurrence, except, perhaps, in a very partial and imperfect manner.

No systematic account of this disease has, I believe, ever been published. It is certain, at any rate, that no notice has been taken of it by any of our surgical and obstetrical authorities, since their works are entirely silent respecting it. Chopart is almost the only writer on the urinary organs that has paid any attention to it; but his account is very imperfect, and consists mainly in the presentation of several cases of one of its more common but least important varieties.

Two distinct forms of this affection have been met with in practice, the complete and incomplete; the former consisting in an inversion of all the tunics of the bladder, while in the latter the inversion is limited exclusively to the mucous membrane. The relative frequency of these varieties is not determined, but it is not improbable that the partial is much more common than the complete, of which, in fact, only a few well-authenticated cases are on record. The distinction is of much practical importance, and therefore demands careful consideration.

Of the *incomplete* variety, the first account of which I can find any

record is the case of M. Noel, surgeon to the Hôtel-Dieu, of Orleans, who communicated it to the Royal Academy of Paris early in the last century. It occurred in a little girl, who had been tormented for several days with retention of urine, attended with frequent convulsions. At the orifice of the vagina was a tumor as large as a pullet's egg, which hung from the urethra in the form of a very thin, transparent bag, filled with a clear limpid fluid. The patient was very ill, and expired a few hours after M. Noel's visit. On examining the body, this celebrated surgeon found that the ureters were enormously dilated, quite equalling in size the colon of an adult, and that the tumor at the entrance of the vagina was nothing but a bag of urine. To account for this singular phenomenon, he supposes that the flow of the urine from the ureters into the bladder was seriously obstructed, in consequence of which it continually accumulated in the interior of these tubes, thereby greatly dilating them, at the same time that it gradually insinuated itself between the mucous and muscular coats of the organ, separating them from one another, and forcing the former at length through the orifice of the urethra.¹

In a case mentioned by Hoin,² the tumor, evidently formed, as was supposed by this writer, of the mucous membrane of the neck of the bladder, was nearly of the shape and size of the third phalanx of the little finger; it appeared to have been produced by the violent straining which the patient, a woman, aged twenty-five years, was obliged to make to void her urine, which was frequently retained; it remained several days in the same situation, and finally slipped up of its own accord.

Other cases of supposed inversion and protrusion of the vesical mucous membrane of the female urethra might be given; but, as the state of the parts was not proved by dissection, no benefit could result from such a course.

To this variety of the disease belongs the remarkable, if not unique, case of Dr. J. Bamberger,³ of a man who was for a long time afflicted with anal fistule, accompanied by a tumor, as large as a small hen-egg, in the perineum, consequent upon a fall upon this region a number of years previously. He was unable to retain his urine, which constantly dribbled away, and thus greatly aggravated

¹ Mémoires de l'Acad. Royale de Chir. t. ii. p. 28. Paris, 1819.

² Essai sur les Hernies, p. 848.

³ Diss. de Intussusceptione Membranæ Urethræ Internæ ex Prolapsu Ejusdem. Wirceburg, 1795.

his sufferings. Whenever an attempt was made to pass a catheter, the point of the instrument was invariably arrested by the tumor. An examination of the body revealed the following circumstances. The right ureter, as well as the right pelvis of the kidney, was widely dilated in its whole length, the coats of the bladder were very thick and muscular, and the urethra was greatly expanded for a short distance beyond the bulb, where it was observed to be abnormally narrow. Into this contracted portion projected a fold of the lining membrane of the bladder, in the form of an acorn, with a small opening capable of admitting a silver probe.

The immediate *cause* of this affection would appear to be a relaxed and weakened state of the mucous membrane of the bladder, attended with dilatation of the urethra. The exciting causes are violent and frequent straining, such as accompanies various impediments to the evacuation of the urine and feces, as stone in the bladder, enlargement of the prostate, stricture of the urethra, hemorrhoids, and other diseases. Protracted and violent cough may be enumerated as a predisponent.

In the *treatment* of this form of inversion and prolapse, the circumstances to be mainly attended to are, first, to enjoin strict recumbency, not for a week or month, but for a long time; secondly, to reduce the tumor carefully, and to counteract afterwards any tendency to protrusion by the frequent use of the catheter, and astringent washes and injections; and, thirdly, to correct the general health by chalybeate tonics and other means. The bowels should be maintained in a soluble condition, and the urine should be voided in the recumbent posture, the patient lying on her side or back. Excision of the protruded parts should be studiously avoided, as it might lead to fatal results.

Of the *complete* variety of inversion and prolapse of the bladder also very little is known. Indeed, so far as my information extends, there are but three well authenticated cases of it on record. Of these, the first of which we have any knowledge, occurred in the practice of M. Percy, by whom it was communicated to M. Chopart.¹ The other two were met with, nearly about the same time, by Dr. Murphy, of Dublin, and by Mr. John Green Crosse, the eminent English lithotomist. A condensed account of these cases, with a few comments, will close this branch of the subject.

¹ *Traité des Maladies des Voies Urinaires*, t. i. p. 399. Paris, 1830.

CASE 1.—An abbess, aged fifty-two, very fat, and habitually affected with a cough, began, in 1785, to experience difficulty in urinating, and pain in the pubic region, which lasted several weeks, when she became easy, and so continued for some months. At the end of this period, her suffering returned, the dysuria changing suddenly into complete ischuria. The introduction of the catheter caused much pain, and brought away but little urine, although none had been voided for thirty-six hours. During the next two years, she had occasional attacks of ischuria, for which she used the instrument; but in general she was able to relieve herself simply by lying on her back and drawing up her thighs. On these occasions she was often conscious of a peculiar movement in the pubic region, which was sure to be followed by a discharge of urine; but whenever this failed to take place, she was obliged to employ the catheter. The cause of this difficulty was at length ascertained to be a tumor, of the size of a pigeon's egg, at the external orifice of the urethra; it was red and fleshy in its appearance, elastic, slightly sensible, and marked by transverse ridges. It was evidently formed by a portion of the bladder, the fundus of which was probably impacted into the neck, and forced through the urethra. It was generally easily returned by the pressure of the finger, or the introduction of the catheter, and very frequently, as before stated, it slipped up of its own accord, sometimes suddenly, and with a peculiar noise, when the patient lay on her back with her thighs drawn up.

Percy who carefully examined this tumor, considered it as a real procidentia of the bladder, produced by the effect of gravitation, the pressure of the bowels, and the shocks of coughing, under which, as has been seen, the woman habitually labored. He thought that the urine, after having accumulated for some time in the organ, unfolded, so to speak, its walls, and thus drew up the protruded portion, which acted temporarily as a stopper in preventing the flow of this fluid. To satisfy himself of the nature of the tumor, he percussed it freely before he attempted to reduce it, in doing which he felt it receding from his fingers as if it were drawn up by some force concealed within the bladder. The moment it disappeared, the urine issued in a full stream and with a whizzing noise, followed by a complete cessation of pain. By his advice, the woman wore a gum-elastic catheter, three inches long and five lines in diameter, which effectually prevented a reproduction of the tumor, except on one occasion, when, in attempting to kneel, the instrument escaped from the bladder, and allowed a portion of the organ to appear in its former situation.

CASE 2.—The case of Dr. Murphy¹ occurred in July, 1829, in a girl, aged four years, who was supposed to be laboring under prolapse of the bowel, which another practitioner, after a tedious trial, had failed to reduce six hours previously. The tumor, which was of a dark mahogany color, and the size of a small hen-egg, was situated at the upper part of the vulva, between the pudendal lips, and was of a pyriform shape, the base being below, and the apex above. On raising it forwards towards the pubes, the mouth of the vagina was brought into view, but the orifice of the urethra could not be detected. The little finger, introduced into the rectum, communicated no motion to the tumor, nor could anything unnatural be observed. The openings of the ureters were looked for, but could not be discovered until the inversion was rendered complete by pulling the swelling gently downwards. A small silver probe was then inserted into each orifice, and, upon withdrawing the instrument, a few drops of urine escaped. The reduction was easily effected by steadying the neck of the bladder with the thumb and forefinger of the left hand, and pushing the fundus upwards with the end of a gum-elastic catheter. The instrument was then retained for a few hours by

¹ London Medical Gazette, vol. xi. p. 525.

an assistant. Some vomiting and tenderness of the pubic region followed; but these symptoms were quickly relieved by leeches, the warm bath, and a dose of castor oil, and in six days the child was discharged cured.

CASE 3.—In Dr. Crosse's¹ case, which also occurred in 1829, but of which no account was published until 1846, the patient was between two and three years of age. The tumor, which was perfectly symmetrical, and situated at the upper part of the vulva, was about the size and shape of a walnut, measuring four inches and a half in circumference at its labial boundaries, and projecting fully nine lines beyond the surrounding surface. It was of a red, florid color, and somewhat granulated on its surface, so as to resemble a large strawberry. Towards the posterior part of the tumor, on its sacral aspect, was an aperture, which, as it readily admitted a small female catheter, followed by a discharge of urine, was supposed to be the urethra. The instrument passed along a channel to the left side of the median line, and, although it appeared to have entered the bladder, the water did not come away in a gush, but in drops. Concealed in a fold of the tumor, near the posterior junction of the pudendal ligaments, were, not far apart, the orifices of the ureters. On pressing the tumor firmly, as if to reduce it like a hernia, it was found to yield, and to recede gradually behind the pubic symphysis, leaving the external parts in their proper shape and position. The replacement being effected, the urethra was observed to form a large, open passage, which readily admitted the little finger into the cavity of the bladder, which had evidently been completely inverted, its mucous lining having, in the progress of the protrusion, become the external covering of the tumor.

The previous history of this case was imperfect, and it is therefore uncertain how long the tumor had existed. It was ascertained, however, that it had been noticed a considerable time before the child had come under Mr. Crosse's observation, and that it had always been attended with an oozing or dribbling of urine. It had also been once replaced, but descended again shortly before this gentleman saw it. No relapse took place afterwards, but, at the age of nineteen, the girl, although healthy in other respects, was still afflicted with incontinence of urine.

Such is a concise but accurate outline of the above cases, as reported by their respective observers. It will be noticed that two occurred in very young children; but whether we are hence to infer that the disease is most common at this period of life, is a circumstance for the determination of which we have no data. It might be supposed, *a priori*, that an affection which is essentially dependent upon a dilated condition of the urethra would be more liable to occur in the old than in the young; but if we may base any conclusion upon the subject, as far as the above cases justify us in doing so, the reverse would appear to be the fact. Lithotomists have long been aware of the circumstance that the urethra is more easily and safely dilated in childhood and girlhood than in middle-aged and elderly females. The probability is that a weakened and relaxed condition both of the urinary apparatus and the general system would favor the occurrence of the disease.

¹ Transactions of the Provincial Med. and Surg. Association, vol. xiv. p. 185. 1846.

It is of great moment that this variety of tumor should not be confounded with other affections, as vascular, polypoid, and other growths occurring in this situation. It is evident that an error of *diagnosis* might be productive of the most serious consequences. It has been already seen that, in the case of Mr. Murphy, the tumor was mistaken by another practitioner for a prolapse of the rectum, a view in which that gentleman himself was at first inclined to coincide; and it was not until after the most patient and thorough examination that he arrived at a proper conclusion. In the case of Mr. Crosse, the professional attendant supposed the swelling to be of a vascular structure, on which account he thought it might be removed by ligature, which he was on the point of applying, when, fortunately for both patient and himself, the true nature of the malady was detected. Had the operation been performed, the child would inevitably have been killed through sheer ignorance.

The most important signs, in a diagnostic point of view, are, the gradual development of the tumor, its soft and fluctuating feel, and the peculiarity of its situation, which is, at first, within the urethra, and afterwards external to the meatus, between the pudendal lips. The swelling is red, scarlet, or purple, according to its age and other circumstances, and as it increases in size it gradually projects beyond the surrounding parts, finally overlapping the perineum and even the anus, as in the case of Mr. Murphy. When we add to these signs the fact that there are usually three distinct apertures on the surface of the tumor, one corresponding with the mouth of the urethra and the other two with the orifices of the ureters; that the tumor is easily reduced by pressure; that the patient is unable to retain her urine; that the part is not particularly tender, sore, or painful; and that there is not, at least not necessarily, any derangement of the general health, the practitioner can hardly fail to detect the true nature of the malady. In making an examination, the patient should always be placed recumbent, with the thighs somewhat flexed on the pelvis, and separated from each other; the pudendal lips should then be held apart, and the tumor carefully inspected at its point of attachment, which is always comparatively narrow, and appears as if it were prolonged into the urethra. Perhaps, however, the most valuable and reliable sign is the existence on the surface of the tumor of three orifices corresponding with those of the urethra and ureters. A polypous tumor, warty excrescence, fungous growth, or encysted formation, affections which are all liable to occur in this situation, may usually be easily distinguished by

their history, by their comparatively firm consistence and solid feel, by their irreducibility, and, finally, by the character of the accompanying local distress, which is sometimes very severe, and may, if persistent, seriously undermine the general health.

The *treatment* of this form of inversion and prolapse has been already referred to in connection with the cases above detailed. The principles on which the reduction should be attempted are similar to those which regulate the conduct of the surgeon in the replacement of hernia; that is, the patient is placed upon her back, the head and shoulders are elevated, and the thighs, flexed upon the pelvis, are widely separated from each other. The great lips are then held apart by an assistant, while the surgeon applies his fingers, previously oiled, to the surface of the tumor, and pushes up that part of it first which came down last, the pressure being maintained steadily but gently until the whole of it has slipped up behind the pubic symphysis. When the swelling is bulky and of long standing, it may be necessary to assist these efforts by means of a catheter applied to the fundus of the bladder, and carried up in the direction of the urethra, as was done so successfully by Dr. Murphy in the instance already mentioned.

It is possible that such a tumor might, from long continuance, friction, irritating applications, and other means, become irreducible, either temporarily or permanently. In either event, it would be proper, before making an effort at replacement, to endeavor to diminish the volume and hardness of the protruded parts by leeches, fomentations, and other relaxing measures. Chloroform might be administered during the process of replacement as a valuable adjuvant.

When the parts have been restored to their natural position, the patient should be obliged to observe, for some time, the recumbent posture; the urine should be drawn off several times a day with the catheter; and, if the tendency to protrusion be considerable, a compress, confined by a T bandage, should be worn upon the mouth of the urethra. When the patient gets up, she should wear an abdominal truss, to afford tone and support to the hypogastric region.

When the urethra is much dilated, an operation may become necessary for the purpose of diminishing its caliber. With this view, the inferior portion of the tube may be divested of its mucous membrane, after which the raw surfaces may be approximated by several points of the interrupted suture, care being taken to draw off the urine several times a day until the consolidation is perfected.

CHAPTER XIX.

URINARY DEPOSITS.

It has been seen elsewhere that the urine, under particular diseased conditions of the system, or of the urinary apparatus, may contain pus, mucus, and other materials, which are either entirely foreign to it, or which enter it only very sparingly in the natural state. It only remains, therefore, in connection with the present subject, that we should consider those substances which are liable to separate from this fluid, either after it has been evacuated and permitted to cool, or while it is still lodged in the bladder, and retains its normal temperature. In the one case, the deposit is amorphous, and termed a *sediment*; in the other, it presents itself either as a crystalline matter, constituting what is denominated *gravel*, or it is converted into a hard solid body, called a calculus, stone, or concretion. The number of substances most liable to be thus precipitated from the urine, is three, namely, the lithic, the oxalic, and the phosphatic. These deposits are accompanied by peculiar *diatheses*, or states of the constitution, under the influence of which they are produced.

I. The *lithic deposit*, as being the most common of all, may be considered first. It derives its name from the circumstance that it enters largely into the composition of several varieties of urinary calculi. It is often called the uric deposit. Lithic acid is a peculiar animal substance, which contains a considerable quantity of nitrogen, and is easily soluble in a solution of caustic potassa, but insoluble in water. It is dissolved by nitric acid with effervescence; and before the blowpipe it emits a disagreeable fetid smell, similar to that of burnt horn, with a combination of hydrocyanic acid. This is owing to the fact that it is always united in the urine with ammonia, with which it forms a salt, the superlithate of ammonia, the acid being in excess. In the natural state of the urine, the acid is held in perfect solution, but in certain morbid conditions of this fluid, or when the acid is secreted in excess, it is thrown down in the form of amorphous sediments, or crystalline salts. The urine

depositing lithic acid always reddens litmus paper, and its specific gravity is generally over 1.020. According to Dr. Bird, it frequently contains an excess of urea, and when this is the case it crystallizes slowly when mixed with nitric acid in a watch-glass.

Of the amorphous *sediments*, there are two, the yellow and the red, their names being derived from the peculiarity of their color. They consist of lithic acid in combination with ammonia, are readily dissipated by heat, and never appear in the urine until after it has cooled.

The *yellow sediment* consists almost wholly of the lithate of ammonia, tinged with the coloring matter of the urine. In its complexion, it runs through almost every intermediate shade between a pale fawn and a deep orange. In some instances it is nearly entirely white. It is of very frequent occurrence, and often disappears with great rapidity, to reappear, perhaps, almost immediately from the slightest causes. Heat readily dissolves it; and the addition of a drop of nitric acid causes a deposit of numerous crystals. An excess of yellow sediment may generally be regarded as denotive of disturbance of the digestive functions, or disorder of the cutaneous transpiration. The urine depositing this substance is of a pale amber tint, more or less acid, and clear when voided. Its quantity is commonly confined within the natural limits, and its specific gravity ranges from 1.015 to 1.025. The yellow deposit is very common in children, and frequently alternates with the crystalline sediment.

The *red sediment* is composed of lithate of ammonia, in union with a peculiar coloring pigment, to which Dr. Bird has applied the term purpurine. This coloring matter is of a highly carbonaceous character, and is always present in those states of the system which are attended with imperfect assimilation, or a want of proper aeration of the blood. Hence, it is very common in fat, indolent persons, who take little exercise, and are fond of the pleasures of the table, and in those who are laboring under disease of the lungs, or chylopoietic viscera. This form of sediment varies in its tint from a pale pink to a deep purple, according to the amount of purpurine present in the urine. A very frequent species is the *lateritious*, or brick-dust sediment, so common in fever, rheumatism, and gout. The *pink sediment*, described by Prout, is merely a variety of this; it is exceedingly rare, and is generally expressive of organic disease of the lungs, liver, or spleen. It is occasionally an accompaniment of hectic irritation, and of dropsical effusions. When there is an

excess of purpurine, the deposit is sometimes of a deep purple color, not unlike that of the blood.

The urine depositing this sediment is of a red, or brownish color, preternaturally acid, and of high specific gravity, ranging from 1.025 to 1.035. Its quantity is ordinarily considerably below the normal standard. By adding to it a drop of nitric acid, it generally becomes turbid, from the precipitation of lithic acid.

The *crystallized sediments*, red sand, or gravel, consist of lithic acid, nearly in a pure state. They appear in the form of minute particles, resembling very much, in shape, size, and color, the particles of Cayenne pepper. Heat does not dissolve them, as it does lithate of ammonia. Under the microscope, they are found to consist of exceedingly delicate crystals, most of which have the appearance of rhombic prisms, which may, therefore, be assumed as their normal form. The most perfect specimens are generally contained in the deposits of yellow sand in the urine of young infants. The crystals are sometimes nearly square; or they are very thin, and longer than broad, so as to represent square tables; or finally, they are so thin as to appear merely like pale lozenge-shaped lamellæ. Occasionally they lie across each other, and are firmly coherent. These varieties have been particularly described by Dr. Bird, and are well shown in the adjoining cut.

Fig. 74.



The color of this crystallized substance is subject to considerable diversity. When the deposit is unaccompanied by fever, it is usually more or less yellow; but when the reverse is the case, it is pale red, lateritious, brick red, or brownish. A pink tint is exceedingly rare. The urine from which the matter is precipitated, is generally scanty, deep-colored, acid, and of high specific gravity. The quantity of this deposit is sometimes astonishingly great. I have seen cases in which it was discharged to the extent of four or five drachms a day for many weeks.

The crystallized lithic deposits may occur at any period, but are most common in young children and aged persons. They are generally produced under the influence of a luxurious, indolent life, attended with dyspepsia, flatulence, acidity, and constipation of the bowels, with disorder of the cutaneous secretion. Frequently they are connected with gout, rheumatism, and chronic disease of the skin. The symptoms which attend them are pain in the loins, urethra, and neck of the bladder; aching and retraction of the

testes; frequent and difficult micturition; impairment of the digestive functions; a dry, harsh, husky state of the skin, and more or less feverishness. The disease often exists at an early period, and is sometimes apparently hereditary.

In the *treatment* of this affection, the first and most important point is to ascertain, if possible, the causes by which it has been induced, in order that we may employ the knowledge thus obtained as the basis of our therapeutic measures. From what has been already stated upon this subject, under the heads of the different lithic deposits, it may be assumed that they are all dependent, either directly or indirectly, upon the retention in the system of an inordinate quantity of albumen, fibrin, and other nitrogenous principles, which, in consequence of derangement of the cutaneous and other emunctories, are obliged to pass off by the kidneys. Of the various causes which may conduce to this result, the most important are, first, debility of the digestive organs, with consequent imperfect assimilative action; secondly, the use of unwholesome food and drink; thirdly, defective oxygenation of the blood, from disorder of the lungs and skin; and fourthly, congestion, irritation, or inflammation of the urinary apparatus. What the immediate circumstances are which tend to influence the different forms of lithic deposits, have not been satisfactorily determined; though chemical science will probably ere long succeed in solving the problem, which, at present, is everywhere surrounded by conjecture.

Looking at the causes, then, which lead to the production of lithic deposits, the first indication is to improve and invigorate the state of the digestive organs. This is to be fulfilled, first, by attention to the patient's *diet*; and secondly, by a proper regulation of his bowels. As a general rule, no articles of food should be permitted that are known to disagree with the stomach. If the sufferer is of suitable age, his own experience will frequently teach him what is wholesome and what is not, in this respect. With children, the matter is different. All kinds of pastry, fresh bread, and oily, fatty, and saccharine substances, should be interdicted. Boiled fish, raw oysters, and the white meats usually agree well with the stomach, and may be used in moderation once a day. For breakfast and supper, the latter of which should always be very light, brown bread, dry toast, and soda biscuit, with a small quantity of butter, and a cup of black tea, will generally be sufficient. At dinner, green vegetables and ripe fruits may be indulged in, provided they do not impede the digestive process, or create flatulence and acidity.

When the stomach can bear and digest them, they are often of great benefit, by the tendency which they have to promote the peristaltic action of the bowels, and to furnish the urine with alkaline matter, thereby preventing the deposit of gravel, or lithic acid. Beef, pork, and mutton, if used at all, should be taken very sparingly. Whatever food be employed, the great and important rule is to masticate it as thoroughly as possible, to eat slowly, and not to overload the stomach, or overtask the powers of this organ. Coffee, beer, and alcohol should be avoided; the first two seldom fail to produce flatulence and indigestion, and the latter is objectionable on account of its tendency to load the blood with carbonaceous matter. If the patient has been accustomed to the use of wine, he should either be obliged to discontinue it entirely, or limit himself to a glass or two of dry sherry or Madeira at dinner. My own observation, however, has abundantly satisfied me that, both in this and the other urinary deposits, brandy and gin are far preferable to wine. Hard water must be avoided.

To regulate the *bowels*, which are often much deranged in this affection, the patient should occasionally take some mild aperient, such as blue mass and rhubarb, or the compound calomel pill, especially if there is evidence of defective or disordered hepatic secretion. Active purgation is rarely required, or proper. While there is much acid in the stomach and bowels, Castile soap may be advantageously united with the cathartic medicines.

To aid in properly oxygenating the blood, *exercise* is of paramount importance. This should be taken daily at stated periods, in the open air, on foot, on horseback, or in a carriage, according to the state of the weather and the convenience of the patient. The former mode, when nothing interferes to prevent it, is perhaps the best, from its tendency to excite the action of the skin, which the others have not. A golden rule is, whatever mode be adopted, never to carry the exercise to fatigue, or to take it immediately after a meal. In both cases, mischief would result; in the one, by causing the oxydation of a large quantity of the muscular tissue, and in the other, by diverting the blood from the stomach, and thereby weakening the digestive powers.

From the intimate relation subsisting between the *skin* and the urinary organs, it need hardly be said that whatever deranges the cutaneous functions has a tendency to lead to the formation of lithic sediments. Hence, in the treatment of this affection, it is a matter

of primary importance to maintain the skin habitually in as clean and pure a condition as possible, by frequent ablution and a change of linen. In warm weather, the surface of the body should be sponged at least twice a day with cold water, either simple, or impregnated with salt, mustard, or red pepper, followed by frictions with a coarse napkin, a hair glove, or flesh-brush. The same plan may be pursued in winter, provided there is no contra-indication to its employment; for there can be no doubt at all that cold ablutions are very decidedly preferable, in this state of the urinary organs, to warm or tepid, inasmuch as they exert a much more invigorating influence, not only upon the skin, but upon the system at large. They are, in fact, to the external surface, what cold air is to the lungs. Nevertheless, a warm bath is occasionally highly beneficial, especially during a fit of the gravel. It has been said that a warm bath, strongly impregnated with carbonate of soda and potassa, is a useful means of conveying alkalies into the blood, particularly if taken when the stomach is empty; but it is questionable whether it has any other effect than that of purifying the skin and soothing the nervous system.

Too much attention cannot be paid in the treatment of this affection, to the body and bedclothes; both should be frequently changed and aired; flannel should be worn next the skin both summer and winter; the patient should avoid exposure to cold, and his sleeping apartment should be frequently ventilated, and, if possible, it should be without fire.

When the lithic deposit is connected with a gouty or rheumatic diathesis, recourse must be had to *colchicum*, preceded and accompanied by mercurial cathartics. In nearly all cases of this kind there is marked derangement of the chylopoietic viscera, which it is important to correct, at least to a considerable extent, before we resort to the exhibition of *colchicum*, with a view of directly improving the condition of the blood and the urinary secretion. Not unfrequently it is necessary to administer mercury in alterative doses in combination with opium, until slight ptyalism is produced. Every physician knows the value of this remedy in gout and rheumatism.

When *tonics* are required, the best articles are quinine, iron, and the mineral acids, particularly the nitric and the nitro-muriatic. The vegetable acids, however, are also beneficial, and occasionally afford relief where the mineral fail. Both kinds may be given

either alone or in combination with some of the vegetable bitters, two or three times in the twenty-four hours. In the lithic deposits attendant upon the exhausting night-sweats of pulmonary phthisis, the best acid is the aromatic sulphuric. Quinine and iron, in the form of sulphate, iodide, or citrate, are particularly indicated in the dyspeptic forms of the affection.

To neutralize any acid that may be generated in the stomach, to prevent flatulence, to preserve the lithic acid in solution, and to tranquillize the bladder, which is often extremely irritable in this disease, *alkalies* must be used. The best, according to my own experience, are the bicarbonate of soda and of potassa, either alone or in conjunction with each other. They should be given twice or thrice a day, in doses of from fifteen to thirty grains, largely diluted with water. The best time of exhibition is about an hour after meals, when the digestive process is in full play. Dr. Bird¹ is in the habit of prescribing what he terms the artificial Vichy water, prepared by stirring half a drachm of bicarbonate of potassa with five grains of citric acid in a tumblerful of lukewarm water. The mixture evolves enough carbonic acid to sparkle, and is not disagreeable. The biborate of soda exerts great influence upon uric acid, and may occasionally be administered beneficially; but it should be used with great caution in females, from its stimulant action upon the uterus. Phosphate of soda, liquor potassæ, and benzoic acid, are also valuable remedies, and may be tried where the more ordinary means fail, or are productive of little good.

Irritation of the urinary apparatus, especially if inflammatory in its nature, may, in general, be relieved by the means already mentioned, or by the application of leeches, cups, and blisters to the lumbar region, the sacrum, or the perineum. The warm bath will also be useful, and anodyne injections rarely fail to afford prompt relief.

Finally, I ought to mention the good effects that may be derived, in the treatment of lithic deposits, from the use of *anodynes*. Of all the remedies which are prescribed for these affections, there are few, if any, which exert a more happy or controlling influence upon the excretions in question. In the milder forms, they often alone effect a cure; while in the more severe, they never fail to mitigate the local distress and improve the general health. The best articles of this class are the salts of morphia, lupuline, and hyoscyamus,

¹ On Urinary Deposits, p. 144. Phila. 1854.

which may be given either by themselves, or variously combined with some of the internal remedies above mentioned. When there is marked disorder of the skin, the anodyne may be administered in the form of Dover's powder, which, while it allays pain, acts specifically both upon the cutaneous and urinary secretions.

II. The *oxalic deposit* holds, in point of frequency, an intermediate rank between the lithic and phosphatic. It occurs in the form of a white, glistening powder, which is suspended in the urine, and manifests no disposition to precipitate itself, unless it can attach itself to some substance capable of constituting a nucleus. Examined

Fig. 75.



transparent crystals, of an octohedral figure, with sharp and well-defined edges and angles. Occasionally, though rarely, they are shaped like dumb-bells, or like two kidneys united at their concavities, and so closely approximated as to appear almost circular.¹ (Fig. 75.) They vary much in their size, but in general they are exceedingly minute. If they are subjected to ignition on platinum foil, the oxalic acid is decomposed, and a small quantity of carbonate of lime is left, which is readily dissolved with effervescence on the addition of dilute nitric acid. Oxalic acid sometimes occurs as

a distinct deposit, in the form of a small concretion resembling a hemp-seed, which may be retained in the bladder, and go on gradually increasing until it constitutes a mulberry calculus.

Urine containing oxalic acid is generally of a distinct amber color; but occasionally it is preternaturally dark or pale. Its specific gravity, which is extremely variable, ranges from 1.015 to 1.025, and is usually greatest in night specimens. The fluid is always decidedly acid, and very frequently contains slight traces of lithic sediment, urate of ammonia, or triple phosphate. In all cases, there is a greater proportion of urea than in natural and healthy urine of the same density; and a very constant phenomenon also is the occurrence of epithelial cells, which generally exist in large quantity, and in a nucleated form. To detect the presence of oxalic acid, the suspected fluid should be permitted to stand for a few hours in a glass vessel. At the end of this time, the upper six-sevenths should be poured off, after which the remainder should be put in a watch-glass, and gently warmed over a lamp. If oxalic acid be present,

¹ Bird, on Urinary Deposits, p. 184. Phila. 1854.

it will manifest itself in a few seconds by falling to the bottom of the capsule, in the form of a white glistening powder. The artificial deposit always has the effect of rendering the urine specifically lighter.¹

The *formation* of oxalic acid is favored by whatever has a tendency to impair the assimilative powers, and to exhaust the vital energies. Hence, it is most commonly induced by errors of diet, or the use of unwholesome food and drink, excessive mental exertion, inordinate venery, exposure to cold, long-continued suppression of the cutaneous perspiration, and injury of the spinal cord, brain, or sacro-lumbar nerves. What the immediate agency is under the influence of which it is developed, is still a mystery. Liebig and Wöhler have shown that oxalic acid is readily formed during the oxydation of lithic acid, and it is probable, therefore, that the process is purely chemical. It has been supposed that the acid may be introduced from without, directly through the circulation, a view which derives confirmation from the fact that certain articles of food, such as rhubarb, sorrel and tomato, which naturally contain this substance in considerable quantity, sensibly promote its formation. It has been ascertained that there is no connection between the oxalic diathesis and diabetes; nor is there any, according to Dr. Bird, between it and saccharine matter.

The *symptoms* of this affection are such as indicate the presence of derangement of the digestive and nervous functions. Dyspepsia exists in a marked degree; the appetite is capricious; the stomach is harassed with flatulence and acidity; the bowels are costive, and frequently tender on pressure, or the seat of colicky pains; the mind is gloomy and despondent; the temper is fretful; the surface is exceedingly susceptible to external impressions; the extremities are almost constantly cold; the sleep is disturbed by disagreeable dreams; and the patient continually broods over his disease, having a thousand misgivings and the most horrible forebodings. Pain in the loins is rarely, if ever, altogether absent; the sexual power is usually much impaired; and the urine is often voided with uncommon frequency, as well as with more or less heat and smarting. As the disorder advances, the patient becomes excessively emaciated, and ultimately falls into a state of confirmed hypochondriasis. Consumptive symptoms are sometimes present in this affection, and in many cases the skin is covered with boils and scaly eruptions.

¹ Bird, *op. cit.*

In the *treatment* of this disorder, the first thing to be done is to improve the general health. Errors of diet, if any exist, must be corrected; all unwholesome and indigestible articles are to be avoided; the food must be thoroughly masticated, and it must be light, bland, and nourishing. A fish diet is occasionally of the greatest benefit. Sugar, malt liquors, and wine are injurious. A small quantity of good French brandy may be taken at dinner; or, in fact, three or four times a day, if there exist marked debility. It will give tone to the stomach, and prevent the formation of acid. The bowels must be maintained in a soluble condition; but active depletion of every description is inadmissible. The body should be well protected with clothing, and the utmost attention should be paid to the skin, which should be washed daily with tepid salt water, or some other stimulating fluid, and thoroughly rubbed with a coarse dry towel, or a flesh-brush. Warm bathing is often of immense benefit. In the milder forms of the affection, especially in summer, nothing makes a more rapid and decided impression than cool ablutions and regular exercise in the open air. When there is a tendency to gout or rheumatism, colchicum and iodide of potassium will be of service, and should be exhibited in the usual manner. Tonics are demanded where there is much debility, with indigestion and emaciation, and the best articles, under such circumstances, are quinine and sulphate of iron, in combination with capicum and hyoscyamus. Sulphate of zinc in the dose of one grain, two or three times a day, is said to answer an excellent purpose in cases of this kind, but I have no experience with the remedy. The mineral acids, as the dilute nitric and nitro-muriatic, also possess valuable tonic properties, and often exert a direct influence upon the renal secretion. When calculi form, and the urine loses its acid reaction, recourse must be had to some of the alkalies, as the bicarbonate of soda and the solution of potash.

III. The *phosphatic deposit* is characterized by its whitish color, by its pulverulent arrangement, by its solubility in dilute hydrochloric acid, and by its insolubility in ammonia and solution of potash. It presents itself under three distinct varieties of form, the triple, the calcareous, and the mixed, each of which demands succinct notice in this place.

1. The *triple phosphate* consists of phosphate of ammonia and magnesia, on which account it is generally called the ammonio-magnesian phosphate. It commonly occurs in minute white crystals,

of a beautifully brilliant aspect, transparent or opaque, and remarkable for their sharp angles and edges. In their form, these crystals exhibit great diversity; but in most cases they are prismatic. Occasionally they have a stellar, penniform, or foliaceous arrangement.¹ (Fig. 76.) They often float on the surface of the urine, especially if it is partially decomposed, and look like an iridescent film of grease. The urine which accompanies this deposit is preternaturally copious, pale, or whitish, and of low specific gravity, ranging from 1.005 to 1.014. It has a faint, sickening smell, which soon becomes ammoniacal and offensive, is very feebly acid, and scarcely, if at all, reddens litmus paper. In some instances of the affection, the fluid is unnaturally dark, brownish, or greenish-brown, decidedly alkaline, and loaded with dense ropy mucus.

Fig. 76.



The triple phosphatic deposit very often alternates with the yellow lithic or calcareous deposit. Old persons are more subject to it than children and adolescents, and it is always associated with great disorder of the digestive organs. The patient is weak, irritable, and bloodless; the slightest exercise fatigues him, and he complains constantly of a dull, heavy, aching pain in the lumbar region. Over-exertion, errors of diet, dyspepsia, severe courses of mercury, and excessive venery, are the most common exciting causes.

2. The *calcareous deposit* is composed of phosphate of lime, and occurs in the form of an impalpable powder, of a whitish, grayish, or drab color. Occasionally it is more or less dark, from the admixture of the coloring matter of the urine. The urine, as in the triple variety, is pale, copious, and of low specific gravity, and readily decomposed by exposure to the atmosphere. The deposit is often accompanied by an inordinate secretion of mucus, and from the fact that it frequently occurs in chronic cystitis, it has been supposed that it is sometimes furnished by the lining membrane of the urinary passages instead of by the urine. Whether this is really the fact, or whether the two phenomena are merely coincident, is unknown. Without altogether denying the power of the mucous membrane of the bladder and kidney to secrete phosphatic matter, I am disposed to regard the occurrence as one of great rarity. If we adopt this view, it follows, as a necessary corollary, that the deposit under consideration is derived in a great degree, if not exclusively, from the urine.

¹ Bird, *op. cit.* p. 227. Phila. 1854.

3. The *mixed deposit* consisting of a combination of the two preceding, is very common, and is supposed to be the result of the joint agency of the kidney, and the lining membrane of the urinary passages. The earthy matter is of a whitish color, partly amorphous, and partly crystallized, and usually intermixed with mucus, which is often secreted in large quantity, and of a ropy, viscid character. The urine is fetid, pale, and abundant, and deposits a thick mortar-like sediment upon standing. The most common causes of this condition are, injury of the lower part of the spine, organic disease of the kidney and bladder, dyspepsia, long-continued bodily fatigue, mental anxiety, night-watching, unwholesome food, and debilitating medicines. Patients thus affected are weak and dyspeptic, irritable, nervous, easily affected by cold, thin and emaciated, and of a gloomy, desponding disposition. The urine is voided more frequently than in health, and with more or less pain and scalding along the urethra. Pain in the loins is seldom entirely absent.

In the *treatment* of this affection, the principal indications are, first, to improve the condition of the digestive organs; secondly, to acidify the urine; and thirdly, to strengthen the system. To accomplish the first of these objects, it is necessary to regulate the diet, and administer mild aperients. Stale bread, soda biscuit, rice, hominy, mealy potatoes, boiled fish, mutton chops, beef-steak, and poultry, are the articles that are best borne under such circumstances; the food should be well masticated, and care taken never to overload the stomach. Ripe malt liquor, or good port, sherry, or Madeira wine, may be used in moderation, and are often of use in supporting the strength. Most commonly, however, where a stimulus of this kind is required, brandy will be found preferable to everything else. Hard water should be avoided. Exercise should be taken daily in the open air, but it must never be carried so far as to induce fatigue; the patient's sleeping apartment should be frequently ventilated, and the whole body should be sponged morning and evening with cool, tepid, or warm water, as may be most agreeable to the feelings. The bowels must be kept open, but not actively purged, with some mild aperient, as blue mass and rhubarb, Epsom salts, or some alkaline mineral water.

To fulfil the second indication, acids are required, of which the dilute nitric is the best. It may be administered by itself, in a large quantity of water, or, what is generally preferable, in union with hyoscyamus, black drop, paregoric, or infusion of opium. Anodynes

can rarely be wholly dispensed with, and are often of immense benefit, from the manner in which they allay pain and nervous irritation. In some instances, the muriated tincture of iron proves useful. When the urine is rendered preternaturally acid, or when there is marked pyrosis, recourse must be had to soda, or soda and potash, along with uva ursi and hop tea. All diuretics, properly so called, are injurious.

The third indication is fulfilled by the use of tonics, such as quinine, bark, and steel; a plain but generous diet; exercise in the open air, and change of residence. A sea voyage is sometimes of immense benefit in this affection. Exposure to cold, irregularities of diet, and indiscretions of every sort, should be avoided, both during the actual existence of this diathesis, and for a long time afterwards, on account of the great tendency to relapse.

When the deposit depends upon lesion of the spinal cord, the internal use of strychnine, and counter-irritation, in the form of blisters, issues, or the hot iron, will be of benefit. If inflammation of the bladder or kidney exists, it must be combated by the ordinary means.

CHAPTER XX.

STONE IN THE BLADDER.

SECTION I.

NATURE AND CAUSES.

MOST urinary calculi originate in the kidneys, from which they descend into the bladder, where, if they are retained for any length of time, they gradually increase in size, and ultimately produce more or less obstruction. Their progress along the ureter is sometimes slow and painful; at other times rapid and almost free from suffering. The amount of the local distress is greatly influenced by the nature of the concretion, and by the degree of resistance afforded by the tube through which the foreign body is obliged to pass. A small, smooth calculus usually causes little inconvenience; while a large, or rough one, often occasions the most exquisite tor-

ture. The process of descent, which generally occupies from twelve to forty-eight hours, is characterized by excessive nausea and vomiting, great restlessness and jactitation, pain in the back, groin, and thigh, retraction of the testicles, numbness along the spermatic cord, a sense of constriction at the umbilicus, and tenderness of the hypogastrium, with coldness of the extremities, rigors, and a feeling of excessive prostration. The urine gradually accumulating behind the calculus, the ureter is slowly dilated, and the concretion at length reaches the bladder, from which it is either ejected, or in which it remains, until it is finally disposed of by operation. As soon as the passage is completed, the pain and sympathetic irritation subside, the patient frequently falling into a tranquil and refreshing sleep. The descent of the calculus from the kidney may be greatly expedited, as well as rendered less painful, by the abstraction of blood from the arm, or the loins and hypogastric region, by large doses of morphia along with castor oil and turpentine, the hot bath, fomentations, and anodyne injections. The free use of chloroform or sulphuric ether will also prove highly beneficial.

Stone occurs at all *periods of life*, from the most tender infancy to the most decrepid old age. Indeed, there is reason to believe that it occasionally exists as an intra-uterine affection. Geyer¹ relates the case of a boy who suffered from calculus of the bladder from birth. He was cut in his twelfth year, when the stone had acquired so large a bulk that it had to be broken before it could be extracted. The whole mass weighed ten ounces. Stahl² found a calculus of the size of a peach-kernel in an infant of three weeks that had suffered great distress from its birth in passing its water. Similar examples are mentioned by Nicolai,³ Armstrong,⁴ Richel,⁵ Greding,⁶ Nosäus,⁷ and others.

A few years ago, I attended, along with Professor Miller, a little boy, fifteen months old, whose right kidney contained nine calculi, of a brownish color, and of an ovoidal shape, the largest of which hardly exceeded the volume of a mustard-seed; they appeared to be com-

¹ Miscel. Nat. Curios. Dec. 11, An. V. p. 456.

² Diss. De Morb. Fœtum in Utero Materno, S. 6.

³ Von. Erzeugung der Kinds im Mutter Leibe, Halle, 1746, p. 223.

⁴ Ueber die Gewöhnlichen Krankheiten Regensb. 1788.

⁵ Volgtel's Handbuch der Path. Anatomie, 3 B. p. 289.

⁶ In Ludwigii Advers. Med. Pract. vol. iii. P. iv. p. 742.

⁷ Journ. de Médecine, t. lxxii. p. 869.

posed of uric acid, and had doubtless existed some months, though there had been no well-marked renal symptoms. The child sunk under a protracted attack of pertussis, attended with pneumonia. My colleague, Professor Rogers, gave me, a short time ago, a calculus the size of a hemp-seed, voided by a little boy, aged eleven months. He had labored under vesical symptoms for about three months and a half, and had latterly experienced pains, which, from their paroxysmal disposition, were supposed to be of a colicky character. About a fortnight after the passage of the concretion just mentioned, another but smaller came away, and from that time on all the vesical symptoms disappeared, the child soon regaining his health and strength. The probability is that, in this case, as in the former, the calculi had originated in the kidney. Such, indeed, in all likelihood, is the manner in which most vesical calculi in infancy and early childhood take their rise.

It has generally been supposed that calculous disorders are most common in *children* before the age of fifteen, but this, I am inclined to think, is a mistake. At all events, the opinion is not sustained by the subjoined statistics, which, if they do not definitively settle the question, go very far towards it.

Table showing the Ages of 6,042 Calculous Patients.

Age.	Norwich.	Bristol.	Leeds.	Moscow.	Civiale. ¹
From 1 to 10 years	281	186	88	305	1,529 = 2,834
" 10 to 20 "	106	65	21	115	772 = 1,079
" 20 to 30 "	48	35	21	32	877 = 518
" 30 to 40 "	48	34	12	11	248 = 358
" 40 to 50 "	47	37	28	8	307 = 422
" 50 to 60 "	96	28	21	2	389 = 586
" 60 to 70 "	70	18	9	1	489 = 587
" 70 to 80 "	8	2	2	0	189 = 201
" 80 to 90 "	0	0	0	0	17 = 17
Total,	704	355	197	469	4,817 = 6,042

If we divide the ages here represented into five periods of twenty years each, we shall have for the first series 3,413 cases; for the second, 866; for the third, 958; for the fourth, 788; and for the last, 17. Thus, it appears that more than one-half of the whole number of calculous cases occurs before the twentieth year, and that the proportion in the next three divisions does not exhibit any very

¹ The cases embraced in Mons. Civiale's list occurred in France, Austria, Bavaria, Bohemia, Dalmatia, Saxony, Denmark, Lombardy, Bengal, Egypt, and other regions.

material difference, while the number in the last is so small as hardly to deserve a place. It is a singular fact, also, that of the 6,042 cases not more than three occurred before the end of the first year, and but a few during the first few months after that time. If the ages in the above cases be divided into decennial periods, it will be discovered that by far the largest number occurred within the first ten years.

In attempting to form a correct estimate of the relative frequency of calculous complaints in children, adults, and old persons, we must not lose sight of the fact that many of the cases which fall into the hands of the surgeon are examples of long standing, extending, perhaps, through a period of many years. Thus, to illustrate my meaning, it often happens that a youth of fifteen is cut for a stone developed in infancy; that a person of twenty-five has carried a calculus since the age of ten; and that an old man has a stone which began to form in middle life. Indeed, it may be assumed, as a general rule, that a number of years usually intervene between the manifestation of the first symptoms of stone in the bladder and the extraction of the same stone by operation.

Moreover, it should be borne in mind that calculous diseases are more frequent, in certain countries, among children than among adults, and conversely. Thus, the greater number of stone cases in Wirtemberg, in the mountains of Switzerland, the Neapolitan States, and in some of the counties of England, especially Norfolk, occurs in young persons, from causes hitherto unexplained. In Kentucky, lithotomy is performed much more frequently upon children under fifteen years of age than upon adults.

It is not satisfactorily ascertained whether this affection is *hereditary*. Certain facts seem to warrant the inference that it is. Thus, Civiale relates the case of a man on whom he practised lithotomy whose mother had had stone, and one of whose children died of it. He also performed the operation on two brothers, whose grandfather and two uncles had labored under the disorder. Prout speaks of a family in which the father, son, and grandson were all affected with uric acid calculi. I have not met with any cases illustrative of the present topic.

It has been long known that calculous diseases are much more common among the *poor* than the rich. This remark is true, there is reason to believe, of these two great divisions of society in all parts of the world where these complaints prevail. It is seldom, comparatively speaking, that a man in the higher walks of life is cut

for stone in the bladder; for one such case, fifty are met with among the lower orders. In England, and on the continent of Europe generally, the children of the laboring classes are much more liable to suffer in this way than the offspring of the middle and higher ranks. The same thing is true, I think, of the working people of this country, though, perhaps, not to the same extent as abroad, owing to the fact that they are usually much better fed and clothed than the corresponding orders in Europe. Upon what this difference depends is not positively ascertained; but the probability is, that it is mainly due to derangement of the digestive organs, engendered by the use of unwholesome food, by irregular habits, want of cleanliness, intemperance, and deficient clothing. Such a state of things cannot exist long without seriously disordering the renal functions, establishing the lithic diathesis, and producing a tendency to the formation of stone in the bladder.

The diseases under consideration do not occur with equal frequency in *all countries*. Thus, in the United States, they are, so far as is at present known, by far more common in Kentucky, Virginia, Tennessee, and Ohio, than in any other portions of the Union. Missouri, Indiana, Maryland, Pennsylvania, and Northern Alabama, also furnish a considerable number of cases. On the other hand, calculous disorders are comparatively infrequent in New York, Georgia, the two Carolinas, Florida, Louisiana, Mississippi, Arkansas, Iowa, Wisconsin, and Illinois. In New Jersey, Delaware, and the New England States generally, stone in the bladder is proverbially rare. The malady is also uncommon in Canada and the other British Provinces of North America; and the same is true in regard to Texas, Mexico, and California, as I have assured myself by repeated inquiries of respectable and intelligent practitioners in those countries. The causes of these differences have not been ascertained; attempts have been made to trace them to the effects of climate, and to the influence of the water, food, and habits of the people, but without success. Further information upon this subject will be given in the Appendix, No. 1, where it will be discussed at some length.

No data of a reliable kind have yet been furnished respecting the prevalence of calculous complaints in the *colored population* of this country, which now amounts to nearly 3,500,000. That stone in the bladder exists among them is well known; but how frequently is a point which remains to be determined. In the former edition of this work, I expressed the belief that the negro race of the United

States was remarkably exempt from this disease, and such, upon more extended inquiry, I am satisfied is the fact, as the subjoined table and statements, although not sufficient to settle the question, attest.

Table of the relative Frequency of Stone among Whites and Blacks.

Surgeon.	Cases.	Whites.	Blacks.	Proportion.
B. W. Dudley	207	194	13	1 in 15½
J. P. Mettauer	91	69	22	1 in 4½
P. F. Eve	24	20	4	1 in 6
P. C. Spencer	15	9	6	1 in 2½
W. H. Gardner	15	12	3	1 in 5
J. C. Nott	12	8	4	1 in 3
J. M. Bush	10	8	2	1 in 6
D. W. Yandell	8	7	1	1 in 8
S. D. Gross	40	38	2	1 in 20
Miscellaneous ¹	21	15	6	1 in 3½
Total	443	380	63	1 in 7

It will be perceived by the above table that the greatest relative number of cases of stone in the colored patients occurred in the hands of Dr. Mettauer and Dr. Spencer, of Virginia; a circumstance which would seem to imply that the malady is more common in that State in the negro and mulatto than in the same classes in other parts of the Union. This, however, is not true, the difference depending upon the difference of the black population, which, in the "Old Dominion," as it is familiarly called, is nearly two-fifths greater than in any other State. A majority of the other cases occurred in Kentucky; some in Tennessee and Alabama, and a few in Georgia, Louisiana, and Missouri.

I find by a reference to the Census of 1850, that the entire population of Kentucky, Virginia, Tennessee, Georgia, Alabama, Louisiana, and Missouri, from which the cases in the above table are derived, is 6,284,984. Of this number, 4,208,217 are whites, and 2,076,767 are blacks. The total number of operations is 443, which gives a proportion of 1 in 14,187 inhabitants. The total number of cases among whites is 380, or 1 in 11,074; among blacks, of 63, or 1 in 32,964. Thus it appears that stone in the bladder is three times as frequent, in the extensive regions above mentioned, among the whites as among the blacks. Upon what this difference depends must, for the present, remain a matter of conjecture.

Dr. Cartwright, formerly of Natchez, and now of New Orleans.

¹ Communicated by Dr. E. D. Fenner, Dr. H. Miller, Dr. Hardin, and others.

who has practised medicine in Mississippi and Louisiana for thirty-five years, and whose acquaintance with southern diseases is both intimate and extensive, informs me that he has not met with a single case of stone in the bladder in the negro race. "Their modes of life," says he, "their gluttony, their fondness for ardent spirits and highly seasoned food, their indiscriminate use of all kinds of water, and their excessive venery, would seem to be sufficient causes for the prevalence of calculous complaints among them; and yet, with the exception of a few cases among those whose backs and kidneys were accidentally hurt, I have never met with an instance of such a disorder."

Urinary calculi are much more frequent in men than *women*, because, in the first place, they are more constantly exposed to the exciting causes of the complaint; and secondly, because of the more complicated structure of the urinary apparatus, which prevents the ready discharge of sabulous matter, and thus favors the formation of stone. But for the latter circumstance, the probability is that young girls would suffer nearly as often as boys.

What influence, if any, *occupation* exerts upon the production of this disorder, we have no statistical facts to determine. In Ohio, and in the southwestern States, especially Kentucky and Tennessee, the great majority of calculous subjects are common laborers, farmers and mechanics, or the sons of persons of this description; and the same is true, I suppose, of the calculous cases in the other States. Persons who are habitually exposed to cold and wet are said to be particularly prone to this complaint; the fact, however, if it be one, requires confirmation before it can be received as true.

Seafaring people are, it would seem, remarkably exempt from urinary calculi. Mr. Copland Hutchison,¹ of England, who has paid much attention to the investigation of the subject, states that, among the whole mass of seamen in the British navy, from January, 1800, to December, 1815, a period of sixteen years, only eight cases occurred, and of these not less than three had entered the service after they had been attacked with the disease. At the Royal Hospital, Greenwich, whose inmates number nearly three thousand, embracing persons of all ages, from twelve years and upwards, not a single operation for stone in the bladder was performed during a period of twenty-seven years. There was, in fact, but one case in which the symptoms of calculus were manifested. It is proper, however, to

¹ Practical Observations in Surgery, p. 308. London, 1826.

state that Dr. Robertson, the physician to the institution, discovered after death small concretions in the kidneys and ureters of several of the pensioners. At the Norwich Hospital, so celebrated for the great number of its calculous subjects, the immunity has been equally great. Dr. Rigby, who was connected with it for many years in the capacity of medical attendant, and who witnessed most of the operations performed in it, declares that, out of between five and six hundred cases, he cannot recollect a single one in which a mariner was lithotomized. The results witnessed at Liverpool, Bristol, Sunderland, Edinburgh, Aberdeen, Leith, and other towns in England and Scotland, all coincide in this particular. The extensive practice of Sir E. Home and Mr. Cline, of London, never furnished them with any examples of stone in seafaring people, and Sir Astley Cooper saw only a few cases. Of two hundred and sixty-five calculous patients admitted into the London Hospitals, from 1761 to 1821, only twelve were mariners. Mons. Civiale¹ observes that, among the great number of persons who have sought his advice, he has had only three who had been a long time at sea. The sailors of the Mediterranean and Adriatic are, he adds, not more frequently affected with stone than the other classes in those regions.

A similar immunity seems to be enjoyed by *soldiers*. From the report of Sir James McGrigor, on the diseases of the British army in the Peninsula, under the command of the Duke of Wellington, it appears that not a single case of calculus was observed among the 340,000 patients that were admitted into the general and regimental hospitals, from December, 1811, to June, 1814.² Sir George Ballingall,³ during a period of nearly forty years' connection with the service, met with only two instances in which stone was ascertained to exist in the persons of soldiers. Mr. Crampton, surgeon-general of Ireland, witnessed only one instance of lithotomy in the army of that country, during a period of fifteen years. According to the late Sir James Wylie, who was for many years resident at St. Petersburg, and physician to several of the Russian emperors, calculous diseases are hardly known in the Russian army. Baron Larrey, who was for a long time connected with the military service of France, declares that the French soldiery are remarkably exempt

¹ *Traité de l'Affectio Calculense*, p. 659. Paris, 1838.

² See Dr. Yelloly's *Remarks on the Tendency to Calculous Diseases*, in the *Philosophical Transactions of London*, 1829.

³ *Outlines of Military Surgery*, p. 818. Edinburgh, 1844.

from these complaints. M. Gama, surgeon-in-chief of the military hospital of Val de Grace, Paris, and formerly surgeon of the military hospital at Strasbourg, states that during the fourteen years in which he was at the head of those institutions, he never had occasion to cut a single patient for stone in the bladder.¹ The military hospitals of Bavaria furnished but two cases of vesical calculi in ten years.²

No facts have yet been published respecting the prevalence of this affection in the army and navy of the United States. I have endeavored to obtain information illustrative of this subject, but have received nothing of a reliable character.

Climate, doubtless, exercises no little influence in the formation of urinary concretions. It has been already stated that, in the United States, this disease is most common in Ohio, Kentucky, Tennessee, and Virginia; a circumstance which, so far as is known, does not depend upon any peculiarity of living, and which may therefore be supposed to be owing to some mysterious operation of the climate. In Holland, calculous disorders are very common, and the circumstance is the more remarkable because of the great use that is made there of gin, which is a powerful diuretic. That this liquor is not the cause of this occurrence is proved by the fact that the Dutch colonists of Batavia, in the island of Java, whose habits are not at all dissimilar from those of the people of the mother country, are almost entirely exempt from this affection. Scemmering informs us that the disease is altogether unknown in some situations bordering on the Rhine.³ Calculous affections are much more common in Manchester and its vicinity than in any other part of England, and yet the habits of the residents there are the same as in other places. In the East Indies, if we may credit the statements of Mr. Brett and other late writers, stone is very frequent. In New England, on the contrary, it is, as has been already seen, proverbially uncommon. It is hardly safe, however, to indulge in any remarks concerning a subject which is involved in so much obscurity as the one under consideration. Much of what has been advanced is wholly conjectural, and, therefore, scarcely worthy of serious attention. Patient and multiplied observations in different parts of the world are alone competent to furnish us with any real and substantial light; for

¹ Yelloly, *op. cit.*

² *Traité de l'Affection Calculense*, par Le Docteur Civiale, p. 658. Paris, 1838.

³ *Coulson on the Bladder*, p. 166. London, 1842.

these we must wait before we are justified in coming to any positive conclusion.

Certain kinds of *food* predispose to the formation of calculous disease. All articles which have a tendency to create acidity and flatulence, must exert a deleterious influence upon the renal secretion, changing its properties, and promoting the deposition of earthy matter. How far the constant use of hot bread, biscuit, and pastry, which are consumed in such enormous quantities in this country, especially in the southwestern States, conduces to bring about calculous disorders, we have no means of deciding. That the daily employment of these articles is prejudicial, no one can doubt. Their influence in producing dyspepsia, so prevalent in every part of the Union, is familiar to every observer, and need not, therefore, be discussed in this place. Hot bread, in its various forms, frequently only half baked, and generally but half masticated before it is swallowed, is sufficient, if used for any length of time, to wear out the strongest stomach, and to break down the most vigorous frame. What the effects of such a state of the system must be upon the urinary secretion, every pathologist knows. A weakened digestion, with a sour and flatulent state of the stomach, constipation of the bowels, and an irritable condition of the brain, cannot by any possibility produce a healthy blood, any more than a morbid state of the blood can produce a healthy urine.

It has been supposed that the use of *corn bread and bacon* predisposes to the development of calculous disorders. That such may be the case is possible; but the fact, if it be one, remains to be established. The negro of the southwest, who employs hardly any other kind of bread, and whose principal meat is salt bacon, is remarkably exempt from this class of diseases; and it is also well known, at least to the practitioners of that region of country, that a great many of the calculous patients there are under five years of age. Now, young children are seldom sufficiently fond of corn bread to make it their principal food; they generally prefer wheat bread, potatoes, and meat, the latter of which is often consumed in large quantities before the completion of dentition. Moreover, in many cases of calculous disease of children, well marked symptoms of the affection are observed before the infant is weaned, and consequently before it has had an opportunity of tasting the kind of bread in question. In Ohio, where stone is perhaps nearly as frequent as in Kentucky, but little corn bread is used, while in the latter State it forms, in many families, the principal table diet. In Norfolk,

England, where calculous complaints are exceedingly frequent, corn bread, as an article of food, is unknown.

What influence, if any, the inordinate use of *coffee and tea* exerts upon the production of this disease, is not ascertained. That they may predispose to the occurrence, especially when they are habitually taken hot, by weakening the digestive powers, and changing the renal secretion, is, I think, highly probable. No facts of a satisfactory nature have yet been published in regard to the agency of wine, cider, malt liquors, and spirits, in producing stone of the bladder.

It was asserted long ago by Scemmering, and the same statement was afterwards made by the late Dr. Leydig,¹ of Maing, Germany, that there is a remarkable exemption from vesical calculus in the principal localities where *Rhenish wines* are manufactured. During a period of thirty-two years, in which Dr. Leydig practised as a consulting and operating surgeon in those regions, he met with only five cases of the disease, embracing one which was not of native origin. None of the patients belonged to the higher orders. He adds that his preceptor, Professor Wiedmann, had never had, during an extensive practice of twenty-five years in the same districts, an opportunity of performing the operation of lithotomy, and that he had seen only one solitary case of stone in the bladder. Dr. Leydig ascribes this remarkable immunity to the constant use, among all classes of society, but particularly the more wealthy and refined, of the good, pure, and wholesome wines, which abound in that country, and which have for a long time enjoyed the reputation of excellent prophylactics against this class of affections. The bitartarate of potash, which most of these wines contain in large quantities, is supposed by Liebig to be changed in the progress of digestion to the carbonate of potash, which produces an alkaline effect, and thus counteracts the tendency to the deposition of uric acid.

Dr. Dobson² remarked, three-quarters of a century ago, that calculous disorders are much more frequent in the *cider* counties than in other parts of England. The fact, if it be one, may, however, be a mere coincidence; for it is very certain that nearly all sections of the United States where cider is used in greatest abundance, are eminently free from this class of affections. In New Jersey, and in certain parts of Pennsylvania, New York, and New England, the

¹ Letter to Dr. Henderson, Lond. Medical Times and Gazette, New Series, vol. iv. p. 449. 1852.

² Commentary on Fixed Air, 8d edit. 1779.

article is drunk in large quantities, and yet it is very uncommon there to see persons suffer under stone in the bladder. Malt liquors are supposed to exert an important influence upon the production of calculous disorders, and it has been alleged, in support of this opinion, that seamen, who have rarely any opportunities of indulging in them, are, in great measure, exempt from urinary concretions.¹

Many respectable writers and practitioners are of opinion that the production of calculous diseases is promoted by the use of hard, impure *water*, in consequence of the changes which it is supposed to induce in the renal secretion. The opinion is plausible, and may be true, but how far, or to what extent, nobody has attempted to decide. If it be true that in Kentucky, Virginia, Alabama, Tennessee, and Ohio, most calculous cases occur in limestone regions, it is equally true that many are found in the freestone districts of those States.

The formation of stone is often remarkably favored by *stricture* of the urethra, enlargement of the prostate gland, and organic disease of the bladder, ureters, and kidneys. Whatever, in fact, has a tendency, for any length of time, to obstruct the flow of urine, or change the character of this fluid; whether during its secretion, or after its arrival in the bladder, may be looked upon as a predisposing cause of this disorder. If the urine happen under these circumstances to be at all surcharged with earthy salts, or even where it contains merely its normal proportions, more or less of these substances is liable to be retained in the bottom of the viscus, where it serves afterwards, in many instances, as the nucleus of a calculous concretion. This liability is greatly increased when there is habitually, along with the mechanical obstruction, an inordinate secretion of mucus.

Injury of the *brain*, spinal cord, or the nerves which supply the urinary organs, especially the kidneys and the bladder, is highly conducive to the development of stone. The properties of the urine are generally more or less altered in this affection, and the fluid commonly contains an unusual amount of saline material. Paraplegia and paralysis of the bladder, if existing for any length of time, are always sure to be followed by the deposition of the earthy phosphates, and in many cases, also, by the formation of stone. Whether these substances are derived, under these circumstances, directly from the urine, or whether they are furnished by the mu-

¹ Hutchison's Observations in Surgery, p. 817. London, 1826.

cous membrane of the bladder, is a point of which pathologists are ignorant.

Finally, the formation of vesical calculus is favored by *gout* and rheumatism. Such at least is the declaration of many writers, both medical and surgical. How true it may be no one knows, for we have no statistical facts upon the subject, and all our other information amounts to nothing but conjecture.

SECTION II.

PHYSICAL AND CHEMICAL PROPERTIES.

1. Most calculi have a central *nucleus*, upon which the earthy matter accumulates or crystallizes. This nucleus may be formed by any solid, or semi-solid substance, whether generated in the urinary organs, or introduced from without. The earthy matter, contained in the urine, gradually collects around this substance, which thus serves as its basis, and assists in moulding its shape. That this is the case, especially with the bladder, is undeniably proved by the well-known experiment of Boerhaave. This celebrated physician introduced a small round pebble into the bladder of a dog. The wound healed perfectly in a very short time. A few months afterwards the animal was killed, and there was found a calculus of considerable volume, of which the pebble was the nucleus. Similar results have been witnessed a thousand times in the human subject, from the accidental or intentional introduction of foreign bodies into the bladder.

The nucleus, in the great majority of cases, consists of some saline matter of the urine, as uric acid, oxalate of lime, or phosphates. The subjoined tables, prepared by Dr. Peter and Dr. Bird, while they serve to place this subject in a tangible form, at the same time afford an opportunity of instituting a comparison between the constitution of American and British calculi. The first relates to seventy-one specimens contained in the Museum of the Medical Department of the Transylvania University, and extracted from an equal number of patients, a large proportion of whom were from Kentucky. The second comprises the results of the examination of 212 calculi in the Museum of Guy's Hospital, London. It is proper to add that, in both cases, I have excluded the duplicate specimens, the retention of which would prevent everything like a just comparative estimate of the results in the two collections.

Nucleus of urate of ammonia . . .	88	Nucleus of uric acid or urates . . .	128
" oxalate of lime . . .	14	" oxalate of lime . . .	47
" phosphates . . .	8	" phosphates . . .	22
" uric acid . . .	6	" cystine . . .	11
" cystine . . .	2	" uric oxide . . .	1
" foreign substance . . .	8	Mixed calculi . . .	8
	<hr/> 71		<hr/> 212

Sometimes, though rarely, the nucleus is composed of inspissated mucus, lymph, or coagulated blood. Occasionally, again, the concretion is formed round a foreign body, introduced either by the patient himself through design or accident, or in the same manner by a second party. A person shot in battle has been known, at a subsequent period, to suffer from stone in the bladder, in consequence of the ball having lodged in that organ, and thus invited, as it were, a deposit of calcareous matter. A surgeon may become the innocent cause of a similar occurrence. In treating a diseased urethra, or in exploring this canal, the bladder, or the prostate gland, the catheter, bougie, or sound which he uses may break off, and afterwards lead to the development of a stone. Many such cases are upon record. A great variety of substances, as nails, tacks, bullets, needle-cases, fruit-stones, peas, beans, pebbles, tents, hairs, small keys, pipe-stems, glass tubes, grass stalks, pieces of straw, pins, and needles, have been accidentally lodged in the bladder, by patients endeavoring to relieve stricture, to procure evacuations of urine, to excite onanism, or create public sympathy. Examples of this kind are, for obvious reasons, more common in the female than in the male. O'Brien relates¹ an instance in which the nucleus consisted of a human tooth; Liston,² one in which it was formed by a brass ring; and Malago,³ one in which it was composed of a globule of mercury. In my private collection is a portion of calculus, presented to me by Dr. Jetton, of Tennessee, which contains three of the caudal bones of a squirrel. The man from whom it was removed was thirty-five years of age, and the probability is that he was in the habit of exciting onanism with the tail of this animal, a piece of which broke off, and slipped into the bladder in an attempt of this kind. In the annexed drawing (Fig. 77), taken from a preparation in the cabinet of Dr. Sabine, of New York, the nucleus consists of a piece of cork. Professor Van Buren, one of the surgeons of

¹ Dublin Journal of Medical Science for March, 1834.

² Edinb. Med. and Surg. Journ. vol. xix. p. 57.

³ Filastre Sebenio, 1845.

the New York Hospital, informs me that he has a stone, the nucleus of which is formed by the head of a stalk of wheat. It was removed from a man nearly seventy years of age. He had introduced the straw for an improper purpose, and the barbs no doubt prevented its retraction; the consequence was that it passed beyond his reach, and ultimately into the bladder.

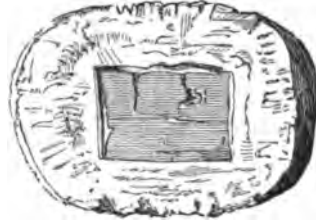


Fig. 77.

The nucleus is sometimes composed of *hairs*, either generated within the bladder, or, as is probably more frequently the case, introduced from without. The hairs which thus, by their interlacement and agglutination, assist in the formation of urinary calculi, are destitute of bulbs, and bear a much greater resemblance to those found in certain cysts and ovarian tumors, than to those of the head. Varying in length from a few lines to several inches, they are of various colors, though, in general, they are white, auburn, or sandy; they may be stiff and firm, soft and very fine, straight or curled.

Several very singular cases of hairy calculi are described by the late J. Cloquet in his *Pathologie Chirurgique*, translated by Dr. Gailick and Dr. Copperthwaite, of London. One of these occurred in an Irish lady who experienced for a long time difficulty in voiding her urine, accompanied with severe pains and an occasional discharge of long hairs. The calculus, which was extracted with the forceps, and which is accurately delineated in Fig. 78, appeared to be adherent to the bladder, and was formed around a lock of hair, nearly six inches in length, slightly curled, destitute of bulbs, and of a light color, some being very bristly, and others woolly. It was of a triangular shape, but rather flat, and of a grayish

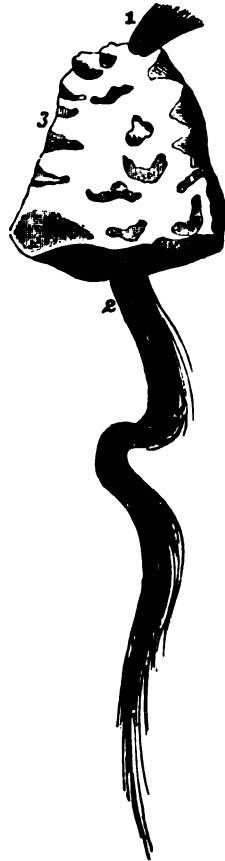


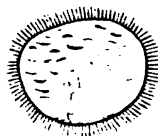
Fig. 78.

hue, interspersed with yellowish spots. The hair of the patient's head was of a light-brown color. The calculus at Fig. 79 was of the size of a hazelnut, composed of oxalate of lime, and formed upon an immense number of short woolly hairs, nearly an inch

Fig. 79.



Fig. 80.



long, and resembling those found upon the organs of generation. The concretion at Fig. 80 was removed from the bladder of an old woman who died at La Salpêtrière. Composed of uric acid and phosphate of lime, it was very soft and friable, rounded and flattened in its shape, of a grayish color, and formed around a nucleus of light auburn hair, some of which were thick and others very fine.

The nucleus varies much in its size, color, form, and consistence. Although generally single, it is sometimes double, triple, and even quadruple; its situation is not always strictly central. The instances in which the concretion is hollow, or the nucleus loose, are rare.

2. Calculi vary much in their *number*. In general, there is only one; now and then there are two or three; and sometimes, though rarely, there are several dozens, or even several hundred. The largest number I have ever found was fifty-four, which I removed from the bladder of an old gentleman, upwards of seventy-six years of age, from Oldham County, Kentucky. They were of a dull whitish color, smooth, irregular in their shape, and from the size of the kernel of a filbert to that of a common marble. Fifty-five were found in the bladder of the celebrated Buffon. Examples are mentioned of sixty, seventy, eighty, ninety-six, and one hundred. Dr. Eve¹, of Nashville, had a case of one hundred and seventy, the largest weighing nearly three drachms, and the smallest one grain. The greatest number ever extracted by Sir Astley Cooper was one hundred and forty-two. Desault took upwards of two hundred from the bladder of a priest. Similar instances are mentioned by Krüger, Dupuytren and others. Dr. John Kelley,² of the State of New York, has published a case of two hundred and twenty-eight.

¹ Southern Med. and Surg. Journal for 1849.

² Amer. Journ. Med. Sciences, Jan. 1847, p. 246.

Tulpius, Boerhaave, Beauchene, and Ribes each record a case of three hundred or upwards. In the instance mentioned by the latter, this number was found after death in a man who had previously undergone the operation of lithotomy three times. Murat met with six hundred and seventy-eight. Schurig, in his "Lithology," refers to a case of seven hundred. The most extraordinary example, however, upon record, occurred in the practice of the late Dr. Physick, who extracted from Judge Marshall, of the Supreme Court of the United States, upwards of one thousand calculi, from the size of a partridge shot to that of a bean. They were all of an oval shape, and were marked each by a small black spot.¹

The mulberry calculus is almost always solitary; and the same is true, but not to the same extent, of the uric calculus. The phosphatic calculus, on the contrary, is not unfrequently multiple. When the concretions are numerous, they are always proportionably small, and more or less smooth on the surface, from the constant friction which they exert upon each other in the bladder. On the other hand, solitary stones are generally rough, and comparatively large.

3. The *volume* of urinary concretions ranges between a hemp-seed and a cocoa-nut. In the great majority of instances it does not exceed that of an almond, a pullet's egg, or a walnut, the latter of which, indeed, it seldom reaches. In young subjects, and in recent cases generally, the size is usually inconsiderable. I have a number of calculi, extracted from children from three to five years of age, which, in their volume, hardly equal a common marble. The size of a urinary concretion, however, does not necessarily depend upon the period of its sojourn in the bladder, or the age of the patient. Occasionally it increases very rapidly, so as to attain a considerable bulk in a very few months; and, on the other hand, it may remain small for many years. In 1844, I operated upon a man twenty-six years old, who had labored under well-marked calculous symptoms from his earliest infancy, and yet the stone was hardly as big as a hen's egg.

The chemical constitution appears to exert no inconsiderable influence upon the volume of urinary concretions; thus, the ammoniaco-magnesian and the fusible calculi are capable of attaining a very large size, while the uric, oxalic, cystic, xanthic, and fibrinous, are almost always comparatively small, no matter what may be

¹ Gibson's Institutes of Surgery, ii. p. 220. Fifth edition.

their own age or the age of the patient. This fact is interesting in a practical point of view; because, by ascertaining the calculous diathesis of the sufferer, we shall be able to form a tolerably correct idea as to the volume of the stone under which he is laboring.

It has been already seen that, when urinary calculi coexist in great numbers, they are always proportionably small. In the most remarkable case of this kind upon record—that of Judge Marshall, previously referred to—the size of none of the concretions, which amounted to upwards of one thousand, exceeded that of a bean, while many of them were not larger than a partridge shot. It is worthy of remark also, that, under these circumstances, the individual calculi are generally of unequal dimensions.

4. The consideration of the *weight* of urinary concretions is necessarily connected with that of their volume. In general, this does not exceed a few drachms or ounces. Out of every one hundred calculi, as they occur in the cabinets of different institutions, or of private individuals, few will be found to weigh more than five or six drachms. One of the smallest ever removed by lithotomy, weighed only ten grains; the operator was Mr. Martineau, of England, and the patient a boy, thirteen years old. Professor Gibson, of Richmond, informs me that he extracted one, not long ago, by a similar operation, from a man of twenty-three, the weight of which did not exceed five grains; it was of a phosphatic nature, and was smaller than a medium-sized grain of coffee. The diagnosis had been made months before the operation, the diminutive volume of the concretion recognized, and every known means employed to induce its evacuation, but without success. In one of my own cases, that of a boy, six years of age, whom I cut in 1846, the weight of the calculus was the same precisely as that of Dr. Gibson.

Many examples, however, are recorded of four, six, eight, ten, twelve, fifteen, and even sixteen ounces. Instances of eighteen, nineteen, and twenty ounces, are related by Borellus, Lusitanus, Cheselden, Pauw, Foschini, Wrisberg, and Sandifort. Fabricius Hildanus describes a calculus which weighed twenty-two ounces, and was four inches and a half in length, by three and a half in breadth. Examples of from twenty-four to thirty ounces are recorded by Deschamps, Pauw, Paget, Tolet, King, and other authors. In the case mentioned by the latter,¹ the patient, who was forty-six years of age, had suffered from his infancy, and the stone was seven

¹ London Medical and Physical Journal for 1828.

inches and a half long, by fifteen inches in circumference. Several instances exist in which the concretion weighed thirty-five, forty, forty-five, and even fifty ounces. Mr. Henry Earle,¹ of London, has published the particulars of a calculus which weighed forty-four ounces, and was sixteen inches in circumference. It was impossible to break it, and the operator was compelled to leave his task unfinished. Deschamps gives a case of fifty-one ounces; Verduc, one of three pounds three ounces; and, as if to cap the climax, Kesselring² one of upwards of six pounds.

5. Not a little diversity obtains in respect to the *consistence* of vesical concretions. As a general rule, it may be said to vary from that of semi-concrete mortar, chalk, or wax, to that of stone or marble. The hardest calculi are the oxalic and uric, which generally emit a clear sound when struck with steel, and cannot be fractured without a considerable degree of force. Calculi, on the other hand, composed of ammoniaco-magnesian phosphate and phosphate of lime, are friable, and easily reduced to powder. In extracting such concretions from the bladder, they not unfrequently break under the pressure of the forceps. The cystic and fibrinous calculi are quite soft, the latter scarcely equalling that of yellow wax. It often happens that one part of a stone is hard and compact, while another is soft, friable, or even pulverulent. This diversity of consistence is strikingly exhibited in what are denominated the alternating calculi, and seems to depend, in great measure, if not entirely, upon the component elements of the different layers of which such concretions consist. It is not improbable that the age of a stone may exert some influence upon its consistence, though it is impossible to estimate the amount or degree of it.

Stones are occasionally composed of a mixture of sabulous matter and hair, more or less intimately matted together. Their consistence resembles that of old lath-plaster; they are easily crushed or pulverized, and they are of a whitish, grayish, or pale drab color. Their formation is of rare occurrence, and they appear to consist principally of phosphate of lime and magnesia. Whence the hair is derived is not ascertained.

6. The *color* of these bodies is not less variable than their other physical properties. The most common shades are white, grayish, drab, fawn, reddish, rose, and brown. Concretions of a bluish,

¹ London Medico-Chir. Trans. vol. xi. p. 82.

² Commer. Liter. Norimb. 1789, hebd. 9.

greenish, black, or slate color are rare. In the alternating calculi, a combination of tints is generally observable, and even one part of the surface of a stone may differ essentially, in this respect, from another. The cystic and fibrinous calculi are of a yellow color, not unlike that of yellow wax; the phosphatic are whitish or grayish; the oxalic, dark or blackish; the uric, rose, reddish, or brown.

7. Most calculi, at the moment of their extraction from the bladder, and for a short time afterwards, emit a strong urinous odor, which they gradually lose by exposure to the atmosphere. It may also be completely destroyed by ablution in warm water, and rapid desiccation before the fire. More or less, however, of the animal matter is usually retained, so that maceration at any future time, if not too remote, is apt to be followed by a slight reproduction of the original odor. When sawed, rasped, or rubbed, urinary concretions give out a smell similar to that of bone, horn, or ivory. Fourcroy considered the spermaceti odor furnished by mulberry calculi, thus treated, as characteristic of the species; this, however, is a mistake.

8. Vesical calculi are capable of assuming a great variety of forms. The circumstances which are chiefly concerned in producing this result are the action of the bladder, the friction which the concretions, when multiple, exert upon one another, and the nature of the nucleus. One of the most constant symptoms of vesical calculus is frequent micturition, at the close of which the bladder always contracts violently upon the foreign body. When this action is uniform, the concretion will be likely to be of a regular figure; but the reverse when this power is exerted unequally. The attrition which vesical calculi, when multiple, experience from the friction to which they are incessantly exposed, seldom fails to effect a change in their configuration. Such concretions are nearly always smooth, angular, and more or less polished, while, on the contrary, the solitary are generally rough and comparatively regular in their shape. The influence exerted by the nucleus in moulding the form of the concretion is well illustrated by those cases in which the deposit takes place around a foreign body, as a bullet, pin, needle, or bit of bougie, accidentally introduced into the bladder. The configuration of the stone, under such circumstances, almost always partakes of that of the extraneous substance. Finally, it is not unlikely that the chemical constitution exerts more or less influence upon the form of the concretion.

Vesical calculi are commonly of an oval form, but occasionally they are round, spherical, or even cylindrical. Other varieties of form are sometimes seen, as the conical, pyriform, cubic, triangular, pyramidal, gourd-like, polygonal, and the tetrahedral. Sometimes the concretion is thin and flat, like a coin, lenticular, semilunar, or in the shape of a mushroom, a kidney, a mulberry, a bean, or a heart. Again, it may be large and bulbous at the extremities, and narrow at the middle, like a dumb-bell. Dr. Mussey, Professor of Surgery in the Miami Medical College, Cincinnati, showed me, some years ago, a most singularly shaped calculus (Fig. 81), which had

Fig. 81.



Fig. 82.



been removed after death from the bladder of a man who had long labored under disease of that organ. It is of a light-brownish color, and consists of a central portion and a number of distinct processes, each of which has a small cavity containing animal matter. The processes are remarkably rough, and several of them are nearly half an inch in length. Its composition is supposed to be oxalate of lime. Fig. 82 represents another very rough calculus, described by Sir Hans Sloan, and probably of the same nature as that of Dr. Mussey. It was removed after death from the bladder of a man, aged sixty-six years.

Large concretions occasionally assume the form of the bladder, and even send prolongations, points, or processes into the urethra, the ducts of the prostate gland, and the ureters. In the case from which the annexed sketch (Fig. 83) was taken, the calculus was lodged partly in the urethra and partly in the bladder, in the former of which it reached as far forward as the bulb; it was cut out of a lad in St. George's Hospital, London, and was composed almost entirely of the mixed phosphates.¹ "In its appearance, it is not unlike the head and part of the neck of a turkey-poult, when prepared for the spit."

¹ Bromfield's Chir. Observations and Cases, vol. ii. plate 10.

Occasionally, again, the concretion consists of several pieces, which are, as it were, articulated with each other, as in the remarkable

Fig. 83.



Fig. 84.



Fig. 83. a. The urethral, and b, the vesical portion.

Fig. 84. a. Urethral portion; b, the scrotal, and c, the vesical.

specimen represented in Fig. 84, copied from Pallucci.¹ In this case, one of the pieces projected into the scrotum and another into the urethra, while the third, or smallest one, lay in the cavity of the bladder. The calculus, which weighed four ounces and a half and was nearly cylindrical in its form, was three inches and three-quarters in length by an inch and a half in thickness. The engraving is about one-half the natural size.

Sometimes several concretions are matted together, so as to form what, in geological language, is termed a pudding-stone. I have never seen an instance of this kind; but a beautiful specimen, represented in Fig. 85, is described by Professor Erichsen, of London.

Fig. 85.



in his recent treatise on surgery. It was removed by him from a child, and consists of eleven distinct lithic acid calculi soldered together by earthy matter.

Morgagni speaks of a stone, voided by a female, which was perforated at the centre. Sometimes a calculus is very porous, or marked by numerous apertures.

¹ *Lithotomie Nouvellement Perfectionnée*, p. 53. Vienna, 1757.

as if it had been exposed for a long time to the action of the urine. In a word, there is literally no end to the grotesque appearances of these bodies.

Finally, the shape of a calculus, as already stated, is sometimes materially influenced by that of its nucleus. If this be very long, as when it consists of a piece of catheter, bougie, straw, or flower-stalk, the concretion will also be apt to be long and slender, the reverse being the case when the nucleus is rounded, or ovoidal. The fact is interesting in regard to the manner in which the foreign body should be seized with the forceps, with a view to its removal from the bladder, whether this be attempted by incision, or the natural channel.

9. The *surface* of these concretions may be smooth or rough. The former is generally the case when several exist together, from the friction which they exert upon each other; when there is only one, however, it is almost always rough. From the cause just mentioned, multiple calculi may not only be smooth, but even highly polished, and rendered angular, polygonal, rhomboidal, or tetrahedral. The oxalic concretion derives its common name from the roughness of its surface, which resembles that of the fruit of the mulberry. The uric acid calculus is usually finely tuberculated. In some of these foreign bodies, the surface is scabrous, mammillated, knotty, convoluted, or covered with spines, prongs, or stalactites.

10. The *chemical composition* of urinary calculi has attracted much attention during the last fifty years, and the individuals who have particularly distinguished themselves for their researches in this respect are Scheele, Bergmann, Wollaston, Brande, Marcet, Fourcroy, Prout, Berzelius, Henry, Scharling, Taylor, and Bird. In this country, the most valuable contribution that has been made to this branch of chemical science is from the pen of Professor Peter, of Kentucky. His paper, which was originally published in the fifth volume of the *Western Lancet*, is founded upon an analysis of seventy-one calculi in the museum of the medical department of Transylvania University, and is one of deep interest, especially in reference to the relative frequency of stone in Lexington, and the surrounding country. During the last two years, my friend Dr. Haskins, of Clarksville, Tennessee, has been engaged in a chemical examination of the urinary calculi of that State, but the results of his observations have not yet appeared in print.

The subjoined account, which is transferred, with little alteration, from my work on *Pathological Anatomy*, includes the most

important species of urinary concretions that have hitherto been described.

The *uric* calculus, called also the *lithic* calculus, the most common species of all, was first noticed by Scheele, in 1776. In its color it is brownish, inclining to that of mahogany, of a flattened oval shape, occasionally finely tuberculated on the surface, but most generally smooth, though not polished, unless there are several concretions at the same time, and from the size of a currant to that of a hen's egg. If the uric calculus be divided with the saw, it will be found to consist of several layers arranged concentrically around a common nucleus, the laminae being frequently distinguishable from each other by a slight difference in color, and sometimes by the interposition of other ingredients. Water has but little action upon it; it is perfectly dissolved by caustic potash; and disappears with effervescence in hot nitric acid, the solution affording, on evaporation to dryness, a bright carmine-colored residue; before the blow-pipe, it becomes black, emits a peculiar animal odor, and is gradually consumed, leaving a minute quantity of white alkaline ashes. Fig. 86 shows the oval shape and finely tuberculated surface of the calculus; Fig. 87 the internal concentric layers.

Fig. 86.



Fig. 87.



As a variety of the preceding, the *uro-ammoniac* calculus may be here mentioned. It is principally observed in children, and is so extremely rare that several distinguished chemists have been induced to deny its existence. It is generally of small size, with a

smooth surface, of a clay color, and composed of concentric rings, which present a very fine earthy appearance when fractured. Much more soluble in water than the uric calculus, it gives out a strong ammoniacal smell when heated with caustic potash, and deflagrates remarkably under the blowpipe. This variety of calculous concretion was first described by Fourcroy.

Next to the uric calculus, in point of frequency, is the *oxalic*, which is generally of a dark brown color, rough and tuberculated on the surface, very hard, compact, and imperfectly laminated, seldom larger than a walnut, spherical, and always single. Under the blowpipe, it expands and effloresces into a white powder; it dissolves slowly in muriatic and nitric acid, provided it be previously well broken up. In the alkalies, it is perfectly insoluble. This species of urinary concretion, called by many the *mulberry calculus*, from its resemblance to the fruit of the mulberry, was first correctly analyzed, in 1797, by Dr. Wollaston, who proved it to consist essentially of oxalate of lime. Figs. 88 and 89 show the external appearance and internal structure of this concretion.

Fig. 88.



Fig. 89.



A variety of this species of calculus has been described by the term *hemp-seed*, from some resemblance which it bears in color and lustre to that substance (Fig. 90). It is always of small size, remarkably smooth, and generally exists in considerable numbers, being rarely, if ever, found alone.

Fig. 90.



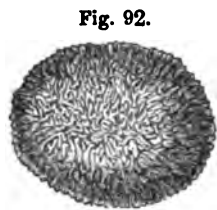
The *phosphatic calculus* (Fig. 91), described by Wollaston in 1797, is of a pale brownish color, and of a loosely laminated structure, with a smooth, polished surface, like porcelain. The shape is mostly oval, and the size, though generally small, is sometimes very considerable. It whitens when exposed to the blowpipe, but does

Fig. 91.



not fuse; and readily dissolves in muriatic acid, without effervescence. This calculus, composed essentially of phosphate of lime, is extremely rare, as forming entire concretions, but frequently constitutes alternate layers with other matters. It is sometimes called the *bone-earth* calculus, and occasionally contains small quantities of carbonate of lime.

The next species is the *ammoniaco-magnesian*, so called from its being composed of the phosphate of ammonia and magnesia (Fig. 92). This mixed calculus is of a white color, friable, crystallized on the surface, and looks a good deal like a mass of chalk; its texture being never laminated, it easily dissolves in dilute acids, but is insoluble in caustic potash; before the blowpipe, it exhales an ammoniacal odor, and at length



melts into a vitreous substance. This species of concretion, first noticed by Wollaston in 1797, sometimes attains an immense size. In a case mentioned by Dr. Thompson, the circumference was fourteen inches, and the weight nearly two pounds.

The *fusible* calculus, the nature of which was first determined by

Fig. 93.



Fig. 94.



Wollaston, consists of a combination of the last two. It is of a white color, extremely brittle, leaves a soft dust on the fingers, and is easily separated into layers; when broken, it presents a ragged,

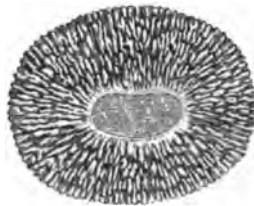
uneven surface. It is insoluble in caustic potash, but gives off ammonia; and, under the blowpipe, it is readily converted into a transparent, pearly-looking glass. This concretion is very common, and sometimes attains a very large size. It is frequently met with as an incrustation of foreign bodies. Figs. 93 and 94 exhibit the outer appearance and internal structure of this concretion.

A very rare species of urinary concretion is the *cystic oxide*, so called from an erroneous supposition that it was peculiar to the bladder. It consists of a confused, crystallized mass, of a white yellowish color, with a smooth surface. The structure is compact, and the fracture exhibits a peculiar glistening lustre, like that of a body having a high refractive density. It exhales a strong characteristic odor under the blowpipe, and is very abundantly dissolved in acids and alkalies, with both of which it crystallizes. This species is commonly of an irregular, spherical shape, and seldom attains a large volume. Wollaston termed it an oxide, and gave it the name of cystic, from a belief that it occurred exclusively in the urinary bladder. It has since, however, been detected in the kidney. The external and internal appearances of the cystic calculus are shown in Figs. 95 and 96.

Fig. 95.



Fig. 96.



As an evidence of the rarity of this variety of concretion, it may be stated that, in the collection of calculi in the Hunterian Museum, embracing six hundred and forty-nine specimens, there are but three of the cystic oxide. The other London cabinets have hardly any examples; and Mons. Civiale, in his immense practice, had, up to 1851, met with it only eight times. The Lexington collection, according to Dr. Peter, contains but two specimens. Dr. J. M. Warren, of Boston, a few years ago successfully removed a concretion of this kind by crushing.¹ I have not found the cystic oxide in any of my operations.

¹ Dr. G. Blackman, New York Journ. Med. and Surgery, Jan. 1852, p. 109.

The *xanthic* calculus was first pointed out by Dr. Marcet, whose account of it is the best that is extant. It is extremely rare. Its texture is compact, hard, and laminated; its color is of a cinnamon brown, its surface smooth, and its volume small. It dissolves very readily in acids and alkalies, and is gradually consumed before the blowpipe, leaving a minute quantity of white ashes.

There is what is called the *fibrinous* calculus. Like the preceding species, this is also extremely rare, and appears to be composed principally of the fibrin of the blood, a property to which it owes its name, and by which it is characterized. Sir Benjamin Brodie¹ has described a concretion of this kind, which was about the size of a horse-bean of an oval shape, and of a yellow transparent appearance, not unlike amber, but less hard. When dried, it shrunk to a small size, and became considerably shrivelled.

There is a singular concretion recently described by Heller, under the name of *urostealith*. It is exceedingly rare, and I do not know that anybody else has noticed it. The specimen analyzed by the German chemist, was obtained from a man of tolerably good constitution, twenty-four years of age, whose chief complaint was pain in the region of the right kidney, with difficulty in micturition. The concretions were of a rounded form, soft, elastic, and from the volume of a hemp-seed to that of a hazelnut, most of them being as large as a pea. They become brittle on being dried, when they present the appearance of wax, of a greenish-yellow hue when viewed by transmitted light. When heated, they melt, and emit a peculiar, pungent odor, similiar to that of benzoin. *Urostealith* is readily dissolved by ether and by solutions of caustic potash, but it is insoluble in boiling water, and nearly so in alcohol. It seems to be composed of a particular kind of fatty matter.²

Finally, all calculi, whatever may be their composition and consistence, contain a certain amount of *animal matter*, which, being diffused through their interior, serves, like so much cement, to bind together their various constituents. It presents itself in different forms, the most common of which are albumen, mucus, and epithelial scales, but occasionally we meet with blood, pus, and other secretions, though rarely in any considerable quantity. The rapidity with which certain concretions are formed is often greatly influenced by the amount of animal matter present in the urine, or upon the sur-

¹ Lectures on the Urinary Organs, p. 214, second edition. London, 1835.

² Simon's Animal Chemistry, p. 635, Phila. 1846; also Markwick on Urine, p. 33, Phila. 1848.

face of the calculus. Professor Scharling,¹ of Copenhagen, lays much stress upon this subject, in relation to which he makes the following pertinent remarks: "The degree of rapidity," says he, "with which precipitation takes place depends on various causes. Among these may be enumerated the envelopment of the nucleus in albumen, blood, mucus, pus, or any other organic matter that chances to be present in sufficient quantity. These form a villous coating around the solid material, and their flocculi arrest, entangle, and ultimately determine the crystallization of the more insoluble ingredients of the urine. This explanation will go far to account for the animal matter contained in all calculi; the presence of which adds so greatly to the difficulty of distinguishing their constituents. It accounts also for the spongy interstices interposed between layers of a denser structure; and explains why certain calculi are full of small foramina.

"These organic substances, as they exist so constantly in calculi, may be regarded as the cement which binds calculous constituents together; and not only favors their increase, but in very many instances first lays the foundation for precipitation. If we attentively examine any of the fissured and perforated calculi so often met with, or those in which a central mass of crystals replaces the usual nucleus, we shall have evidence of the manner in which a clot of blood, or a flake of mucus or albumen, detains the solidifiable ingredients, the hydrate, as it were, and forms the elements of a nucleus, which consolidates, and in its turn constitutes the centre for future deposition."

Dr. E. B. Haskins,² of Clarksville, Tennessee, who has recently investigated this subject, has ascertained that if a small quantity of calculous matter, imperfectly pulverized, and partially dissolved, be placed under a microscope, the particles thus treated will be found to be enveloped by a pellicle of transparent animal matter, which, when completely divested of salts, bears so great a resemblance to epithelial scales as to be easily mistaken for them. His observations, which were made with much care, confirm those of Scharling and other chemists in relation to the intimate penetration of all calculi by this substance, which thus forms, as it were, a kind of network for the reception and accommodation of the saline deposit.

¹ On the Chemical Discrimination of Vesical Calculi, translated by Dr. S. E. Hoskins, p. 114. London, 1842.

² MS. letter to the author, July 29, 1854.

In addition to this matter, Dr. Haskins often detected in the concretions which he examined, epithelial scales from the bladder and kidney, fibrinous casts from the uriniferous tubes, and a peculiar fibriniform matter without any definite structure. The central portion of the concretions always contained a large proportion of these substances, which were sometimes easily broken down, but in general they were tough and adherent. He thinks, moreover, that no calculus can form without the aid of matter foreign to the urine in a chemical sense, and that this matter is, as has been already seen, uniformly of an animal character.

SECTION III.

SITUATION.

Calculi generally lie loose within the cavity of the bladder, and are, consequently, liable to shift their position, not only with that of the viscus in which they are contained, but also with that of the body. Hence, at one moment they may be at the *bas-fond* of the organ, at another at its neck, at another at its superior portion or base, at another at its sides, and at another, perhaps, at its anterior part just above or behind the pubes. A knowledge of this variation, in the position of these foreign substances, is of no little importance in regard to the operation of sounding. Their most common situation is, undoubtedly, the *bas-fond* of the bladder, from the fact that this is the most dependent portion of the reservoir. In old subjects, affected with enlargement of the prostate, the concretion generally lies just behind this body, in a sort of pouch, hollow, or *cul-de-sac*. When this is the case, and the calculus is of large size, it may often be easily felt by the finger in the rectum. When the bladder is perfectly sound, the concretion, especially when the patient is in the erect position, and the urine evacuated, rests against the neck of the organ, and sometimes even projects into the orifice of the urethra.

Cases occur in which the concretion is alternately loose and fixed. This may be owing to several circumstances, of which the most constant, perhaps, is the existence of an abnormal pouch. The foreign body may also be arrested in the folds of the mucous membrane, in the depression behind the prostate, in the substance of this gland, in the orifice of the ureter, or in the mouth of the urethra.

Vesical calculi may become permanently *adherent*, attached, or fixed. This may take place in different ways, and in a variety of

circumstances. The following may be mentioned as the most important: 1. An effusion of coagulating lymph; 2. The formation of an abnormal pouch; 3. The existence of a fungous tumor or excrescence; 4. A bilobed state of the bladder; 5. The projection of the concretion into the ureter, or some other passage; 6. Its lodgment in the wall of the bladder.

1. The continual irritation caused by the presence of a calculus may lead to an effusion of *coagulating lymph*, the quantity of which, however, is rarely considerable. When this substance possesses a good deal of plastic power, it may become organized, notwithstanding the heterogeneous character of the urine with which it is incessantly in contact. Abnormal bands may thus be formed, by which the foreign body is tied to the inner surface of the bladder, and permanently retained in its place. Or the quantity of lymph poured out may be so great as to surround and almost bury the concretion. In either case, its extraction may be attended with much difficulty.

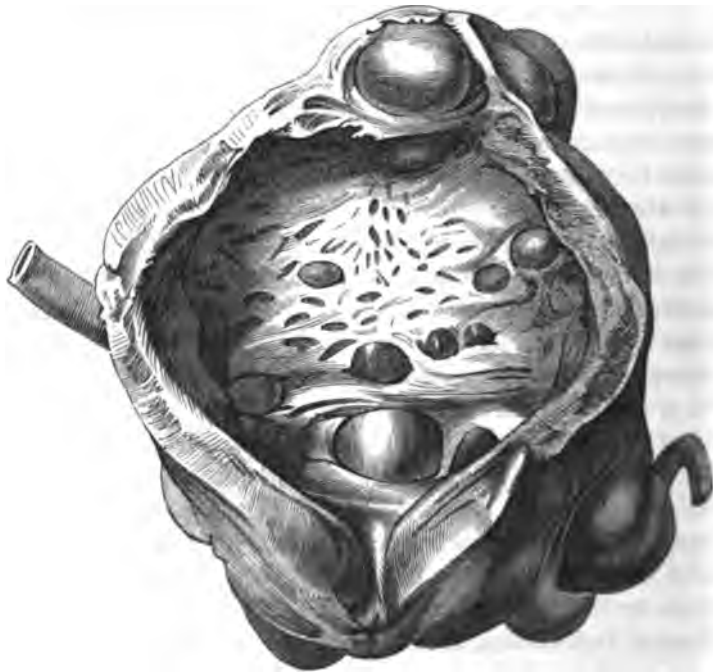
2. Sometimes the calculi are contained in distinct *cysts*, sacs, or pouches, formed, as has been already seen, by a protrusion of the mucous membrane across the muscular fibres of the bladder. Whether they are originally developed in these abnormal receptacles, or whether they are formed in the bladder, and find their way accidentally into them afterwards, is not clearly known. The probability is that both modes occasionally obtain. The volume of the incarcerated concretion is seldom large, nor is it often that more than one is contained in one pouch. Every sac, however, even if there be a considerable number, may be occupied by a stone.

One of the most beautiful and interesting specimens of encysted calculi of the bladder, of which I have any knowledge, is preserved in the Museum of the Medical College at Richmond, Virginia. The individual from whom it was removed had been a patient of Dr. T. Johnson, of that city, who had known him for several years, and attended him during his last illness. From the history of the case, as given by this gentleman, and which, through the kindness of Professor C. Bell Gibson, is now before me, I learn that he was an old pauper, who had always enjoyed remarkably good health, notwithstanding his intemperate habits and frequent exposure to the vicissitudes of the weather. At the time of his admission into the almshouse at Richmond, about ten days before he died, he was very feeble, but free from pain and fever; his alvine and urinary discharges were regular, and he had never, so far as could be ascer-

tained, passed any calculi either before or during his present illness. He was allowed whiskey and a generous diet, but took no medicine.

On examining the body, Dr. Johnson found a tablespoonful, or more, of calculi lying loosely in the bas-fond of the bladder. The whole internal surface of the organ was studded with concretions, which were contained in distinct sacs, but from which most of them could be easily removed. Many small and some large ones, the latter as much as three-eighths of an inch in diameter, were completely encysted. The bladder was unusually large, the fundus mounting above the brim of the pelvis. The left kidney contained an abscess, which had not yet discharged any of its contents. The cephalic and thoracic organs were normal, as were also most of the abdominal. The annexed engraving (Fig. 97), copied from an

Fig. 97.



admirable drawing, made expressly for me, by Dr. A. E. Petricolas, Demonstrator of Anatomy in the Medical College at Richmond, affords an excellent view of the interior of the bladder, and of the size, form, and situation of the encysted calculi.

8. A stone may become fixed by a *fungous tumor* or *excrecence*

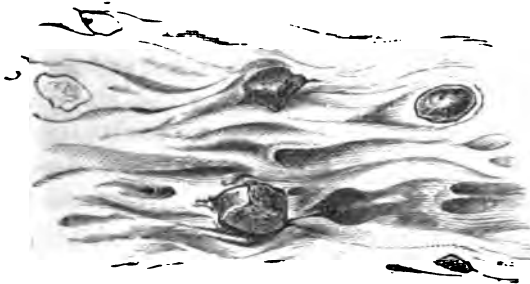
of the bladder. This occurrence, although rare, has been noticed by different observers. The most common situation of this morbid growth is the bas-fond of the organ, where it may acquire a volume ranging between that of a marble and that of a pullet's egg. When the stone is unusually rough, knobby, or spinous, an attachment may easily be formed between it and the tumor, by the processes which the latter sends into the openings, or round the projections of the former. The adhesion thus established may be very firm, especially if there be at the same time a considerable effusion of lymph.

4. A *bilobed* state of the bladder is sometimes observed, the organ consisting, as the name implies, of two compartments, of which the smaller one is usually above the other. A calculus, developed in the lesser pouch, may not be able to pass into the larger, in consequence of the small size of the opening of communication, and may, therefore, be regarded as extra-vesicular.

5. A stone may become permanently *impacted* by projecting into the urethra, the canals of the prostate, the orifice of the ejaculatory ducts, or the outlet of the ureter. The latter accident may happen in consequence of the imperfect descent of the concretion, or the calculus may be developed in the bladder, and be gradually prolonged into the tube. In a few rare instances, the stone has been known to project into both ureters as well as into the urethra.

6. The concretion is occasionally *imbedded* in the wall of the bladder. The sabulous matter, in this case, is probably deposited originally into a mucous follicle, lacuna, or fossa, where it gradually augments in quantity, and effects a secure lodgment by raising the mucous membrane over its surface, and contracting firm adhesions

Fig. 98.



to the muscular fibres beneath. Several such calculi are represented in the annexed drawing (Fig. 98). In general, the concretions are

small, though they have been known occasionally to acquire a considerable bulk. In their number, they may vary from one to half a dozen or even more. An example has been recorded in which a calculus was lodged between the coats of the bladder.

7. Finally, the calculous matter, instead of being collected into a distinct concretion, is sometimes spread out in the form of a *layer* upon the *bas-fond* of the bladder. The crust thus formed is of variable extent, and ranges from the merest lamella to a mass several lines thick. In the latter case, it generally exhibits a concentric, stratiform arrangement. Its adhesion to the bladder is sometimes so firm as to render it difficult for the surgeon to break it. A layer of this kind, of considerable thickness, now and then forms around a spongy, erectile, or fibrous tumor of the bladder. When the calculous matter presents this peculiar arrangement, it grates under the instrument, and can be distinctly felt through the rectum. When struck with the sound, it emits a peculiar noise, not unlike that of a cracked pot. I have seen several specimens in which this lamelliform arrangement coexisted with separate calculi.

SECTION IV.

STONE IN THE INFERIOR ANIMALS.

It is curious, as well as instructive, to find that stone, which is so frequent in the human subject, also occurs in the inferior animals. A knowledge of this fact affords an additional illustration of the nature and origin of the disease in man.

Stone has been found in many orders of the mammalia, herbivorous and carnivorous, in birds, fishes, and reptiles. The probability is that it is much more common in all these classes than is generally supposed. Short-lived as many of them are, and simple as are the habits of most of them, it is well known that many of them, especially among the domestic quadrupeds, are liable to the heterologous formations, and to various kinds of calcareous deposits. In the horse, ass, ox, sheep, dog, and hog, urinary concretions have been noticed from time immemorial.

In my private collection are three beautiful specimens from the bladder of the hog, presented to me, respectively, by Dr. Clapp, of Indiana, Dr. Osborne, of Alabama, and Dr. Ector, of Georgia. They vary in their composition, shape, and size, the largest weighing

eight ounces. Professor Cobb has a magnificent calculus from the bladder of a dog.

Rats and mice are said to be particularly subject to urinary calculi, and the disease is also met with in the cat and rabbit. Among birds, it has been noticed in the eagle and the ostrich, but chiefly in domestic fowl; but whether the latter are more liable to it than wild fowl is unknown. Landerer¹ has published the results of an analysis of a urinary concretion taken from a pelican. Several varieties of fishes, especially the sturgeon, are liable to it. Among reptiles, it has been found in the tortoise and the boa constrictor. The younger Professor Silliman has a beautiful specimen from a whale. It is perfectly white, of a triangular shape, and forms one of at least half a bushel of similar concretions obtained from the same animal.

In the higher orders of animals, the constitution, symptoms, and morbid appearances are very similar to those observed in the human subject. Generally speaking, the calculi of the herbivora consist of earthy phosphates and carbonates, while those of the carnivora contain, in addition to these and other ingredients, a considerable proportion of uric acid. In reptiles, the chemical composition of these concretions is much the same as in the latter class of animals. In a urinary calculus from a boa constrictor, Wurzer obtained forty parts of uric acid, nineteen of phosphate of lime, eighteen of urate of ammonia, nine of urate of soda, ten of albumen, and three of organic matter, with a minute quantity of iron and manganese. Vauquelin analyzed a urinary calculus found in a tortoise, and ascertained that it was composed of chloride of sodium, phosphate of lime, uric acid, and animal matter. A stone, removed by Lesueur,² the naturalist, from the *Trionix spinosus*, a species of ray found in the Wabash River, in Indiana, afforded, on analysis, the following results:—

Phosphate of lime	56.19
Carbonate of lime	8.09
Carbonate of magnesia	1.10
Silica	4.76
Salts and soluble organic matter	1.91
Animal matter, insoluble in water	18.00
Water	20.00
	<hr/>
	100.00

The calculus, which was of a roundish, flattened form, was of a pale yellowish color externally, and white within. It was composed

¹ Buchner's Rept. vol. lxii. p. 63.

² London Lancet, Oct. 1844.

of concentric layers, weighed upwards of half an ounce, and had a specific gravity of 1.875. Another calculus, much smaller than the preceding, had a delicate nucleus, evidently composed of a fragment of a shell.

SECTION V.

SYMPTOMS.

The symptoms of stone in the bladder may be conveniently divided into the rational and physical; or into those which are furnished by the suffering organ and the parts in its immediate vicinity, and those which are derived by the surgeon from a careful manual exploration. They may be divided, moreover, into local and general, as they affect the urinary apparatus, or the system at large.

The rational symptoms, which may be considered first, are not only numerous but considerably diversified in their character. They may be thus enumerated: 1. Pain in making water, especially when the last drops are expelled, felt both in the bladder and the adjacent parts. 2. A sense of weight and uneasiness in the pelvis, anus, and perineum. 3. Frequent micturition. 4. An occasional interruption of the stream of urine. 5. Pain and itching in the head of the penis, with smarting or pricking sensations in the urethra, particularly at its orifice. 6. Enlargement of the penis and elongation of the prepuce. 7. Occasional priapism, with or without sexual desire. 8. An increased secretion of mucus from the lining membrane of the bladder. 9. A bloody state of the urine. 10. Incontinence of urine. 11. Prolapsus of the anus. 12. Sympathetic suffering. 13. Noise furnished by the calculi knocking against each other in the bladder.

The above symptoms usually come on gradually, and a considerable period often elapses before the patient is led to suspect the real nature of his condition. This is especially the case when the general health is good, and the bladder perfectly sound. Indeed, under such circumstances, the organ may, for a long time, take no cognizance of the presence of the foreign body. Gradually, however, marks of the disease are developed, and assume such a character as hardly to admit of being misinterpreted. Pain is felt at the neck of the bladder, reflected along the course of the urethra, and particularly keen during the emission of the last drops of water; the desire to urinate is more frequent than natural, and the

effort to resist it more unavailing; there is a sense of weight or uneasiness in the perineum and anus; the stream of urine is often suddenly interrupted; more or less distress is experienced in the head of the penis; and, finally, every attempt at micturition is attended with straining and tenesmus. To these symptoms are gradually superadded most, if not all, of those above indicated. No regularity or uniformity, however, is witnessed, as a general rule, in the manner of their appearance. We may next proceed to examine these symptoms in detail.

1. *Pain*.—This is usually one of the earliest symptoms of stone in the bladder. Although nearly always present, yet it varies very much in different cases, both as to its character, intensity, extent, and duration. It is commonly of a sharp, darting, pricking, or burning nature, and is felt most keenly at the neck of the bladder, just before, during, and for a few minutes after micturition. Not unfrequently it is dull, heavy, or aching. Sometimes it is periodical, and apparently of a neuralgic nature, recurring regularly once or twice every twenty-four or forty-eight hours, precisely like the paroxysms of an intermittent fever. Of this variety of pain several well-marked examples have fallen under my observation. The patients were all under six years of age, and had not been exposed, so far as could be ascertained, to any miasmatic influence. When the pain is neuralgic, and distinctly periodical, the suffering in the interval is generally mild. A case, that of an individual who had labored under stone for a long time, is mentioned by Deschamps,¹ in which the pain, of a sharp, cutting character, came on regularly for upwards of eight months, at every return of the new moon. It increased as she became full, and decreased as she declined. The patient was perfectly comfortable in the intervals.

The pain, whatever may be its character, is generally aggravated by rough exercise, as leaping, running, or riding on horse-back; by pressure on the hypogastric region; by distension of the rectum; and even by a mere change of the position of the body. It is always exceedingly severe when the last drops of urine are expelled, because the bladder is then tightly contracted, and brought fully in contact with every portion of the stone. The suffering, in this affection, is considerably influenced by the form and volume of the concretion, the condition of the mucous membrane of the bladder, the temperament of the patient, and the state of the general health.

¹ *Traité de la Taille*, t. ii. p. 188.

A voluminous stone causes more pain than a small one, because it impinges against a larger surface; and a rough stone more than a smooth one. This, however, is not always true. When the stone is spiculated, or studded with long spines, the suffering is sometimes very slight, probably because they admit of the more ready passage of the urine, in the same manner that a very rough body lodged in the bronchial tube will occasionally cause less distress than a smooth body, because it produces less obstruction to the entrance of the air.

Even the nature of the concretion appears to be capable of producing a difference in the amount of suffering. Thus, the phosphatic and uric calculi almost always create more constant and severe pain than the oxalic, cystic, and fibrinous. An inflamed, ulcerated, or hypertrophied bladder is less patient of its contents than a comparatively healthy one. The pain is also greater when the calculous affection is complicated with disease of the kidney, ureter, prostate gland, urethra, testis, anus or rectum. A nervous temperament and an irritable state of the system materially influence the local suffering. Gouty and rheumatic subjects, laboring under stone of the bladder, often experience severe fits of pain during cold and damp states of the weather. Irregularity of diet or intemperance of any kind will produce the same effect.

An adherent, fixed, or encysted calculus creates less local irritation than one that is loose, or free; and one that is situated in the side of the bladder than one that is habitually in contact with the trigone or neck of this organ, for the reason that these parts are naturally more sensible and intolerant. Sometimes temporary alleviation is experienced from the surface of the concretion becoming coated with lymph, blood, or mucus, which thus destroys its irritating character. Old men who never completely empty the bladder, and persons affected with paralysis of this organ, suffer little pain from this disease.

Finally, the pain in this disease may be slight or severe, transient or constant. Confined at first to the bladder, it generally soon extends to the neighboring parts, as the urethra, penis, testicles, perineum, anus, thighs, groins, and even the lumbar region. One or both testicles often become painful, and are commonly retracted whenever there is a severe fit of suffering. Numbness of the thighs is complained of by many patients.

2. *Feeling of Weight and Uneasiness in the Pelvic Region.*—Most patients affected with vesical calculus experience a sense of weight, aching, soreness, uneasiness, or fatigue in the lower part of the pelvis,

perineum, and anus, with numbness and darting pains in the thighs and pubic region. It is often present at an early stage of the complaint, and is seldom entirely absent in any instance. Rough exercise, sexual intercourse, and pressure on the hypogastric region, always increase it; and it is generally more constant and severe when the stone is voluminous than when it is diminutive.

3. *Frequent Micturition.*—A very prominent, early, and constant symptom of this disease is a frequent desire to urinate. Instead of passing his water four or five times in the twenty-four hours, the patient is perhaps obliged to void it every hour and a half or two hours. In some instances, indeed, the calls to make water are almost incessant, and what increases the distress, in such cases, is the inability to resist them. This symptom, which is liable to be greatly aggravated by certain states of the urinary apparatus, as, for example, an ulcerated condition of the lining membrane of the bladder, hypertrophy of the prostate gland, or stricture of the urethra, generally exists at a very early period of the disease, when the stone, perhaps, has not yet acquired the bulk of a hazel-nut, or even a cherry. It evidently depends upon a morbid sensibility of the neck of the bladder, caused by the frequent contact of the foreign body, and is always increased, or temporarily aggravated, by rough exercise, by the operation of sounding, the use of drastic purgatives, and various other causes.

4. *Interruption of the Stream of Urine.*—Another very valuable, because a very constant symptom of stone in the bladder, is a sudden stoppage of the flow of water. This is so common an occurrence that it may be regarded almost as pathognomonic. It is caused by the sudden falling of the concretion against the neck of the bladder, and so producing a partial or complete occlusion of the orifice of the urethra. It generally makes its appearance early in the disease, and is often one of the first symptoms that attracts attention. As it may occasionally be absent during urination, so it may sometimes come on repeatedly during the same excretion. The interruption thus caused, although generally momentary, may endure several minutes, or even much longer. A change of posture, gentle pressure on the hypogastric region, anus, or perineum, or rest for a few minutes on the back, usually suffice to dislodge the stone, and to free the orifice of the urethra. Occasionally, however, it happens that the concretion is firmly impacted in this tube, and then the stoppage amounts to a real retention, requiring the use of the catheter to push the intruder out of the way.

5. *Posture in Urinating.*—A stooping posture is usually adopted during micturition; but not unfrequently, the patient is obliged to place himself in a particular attitude. Thus, he sometimes crosses or separates his legs, inclines his body to one side, lies down, bends forwards, or supports himself upon his knees and elbows; sometimes he leans over and rests on his head. One of my patients, a lad, five years old, was constantly in the habit, when passing his water, of lying on his back and throwing his buttocks up in the air. Professor Eve,¹ of Nashville, lithotomized a man, who, for two years previously to the operation, was obliged, whenever he wished to urinate, to assume the horizontal posture, and push up the bladder, which contained one hundred and seventeen calculi, with his fingers in the rectum. The object of all such manœuvres, of course, is to avert pain by preventing the stone from interrupting the stream of urine, or by reinventing the flow when it has been arrested.

6. *Pain in the Head of the Penis.*—After the disease has continued some time, and occasionally even in its earliest stages, the patient experiences pain in the head of the penis, accompanied with a sense of smarting, scalding, itching, or pricking in the canal and orifice of the urethra. This symptom is often extremely unpleasant, and constitutes a source of real suffering. It exists in varying degrees, from the slightest uneasiness to the most excruciating torture. From personal observation, I am satisfied that it is much more frequent and severe in the young and middle-aged than in the old, in whom it is sometimes very slight. It is seldom wholly absent in any case. To mitigate this distress, which is generally very much aggravated during micturition, the patient soon acquires the habit of forcibly grasping the penis, and not only compressing, but stretching it. How this pain is produced we do not know, unless we account for it on the principle of continuous sympathy. An analogous instance is afforded in the hip-joint disease of children, in which the earliest and often the most prominent symptom complained of is pain in the corresponding knee.

7. *Enlargement of the Penis and Prepuce.*—In consequence of the suffering just adverted to, the patient, as already intimated, frequently grasps the penis, pulling and compressing it to obtund its sensibilities. What his instincts prompted him to do in the first instance, to mitigate his pain, habit rapidly confirms, and hence it is not uncommon with this class of patients to have the hand constantly in the breeches. Disgusting as the practice certainly is, it

¹ Southern Med. and Surg. Journal for 1849.

is, nevertheless, entirely pardonable when we remember the object of it. Indeed, there would seem to be, in many cases, a positive necessity for it. From the constant employment of it, the head of the penis is rendered not only unnaturally large, but the whole organ is increased in volume, and the prepuce more or less thickened and elongated.

8. *Priapism*.—From the constant irritation of the neck of the bladder, the urethra, and other parts, and the habitual traction and compression of the penis, frequent priapism takes place, with or without sexual desire. This symptom is often present at an early stage of the disease, and is sometimes witnessed in the most tender infants. The erections vary much in their frequency and duration. Their obstinacy is sometimes remarkable. After puberty, they are occasionally attended by emissions, from the irritability being communicated to the seminal vesicles.

9. *Increased Secretion of Mucus*.—A very common attendant upon stone is an inordinate secretion of mucus from the inner surface of the bladder. This, like some of the other symptoms already described, shows itself at a variable interval during the progress of the malady, being sometimes present early, and sometimes not until late. The quantity of the discharge is commonly less in the young than in the aged, in recent cases than in old, and in a healthy than a diseased bladder. Rough exercise, exposure to cold, and indiscretions of diet, have a tendency materially to increase it. Appearing occasionally in small flakes immediately after micturition, it is generally so intimately blended with the urine as not to show itself until this fluid is cooled, or has stood some time in the chamber. It may be clear and thin, like a solution of gum Arabic; or of a grayish, drab, or yellowish color; and of a thick, ropy consistence, similar to the white of an egg. In the latter case, it is usually more or less fetid, becomes rapidly decomposed after it is emitted, forms a thick, tough layer at the bottom of the receiver, and constitutes not unfrequently one-fourth, or even one-third of the entire excretion. The urine is then also variously altered, not only in quantity but likewise in quality, and frequently contains, in addition to the mucus, more or less sabulous matter.

10. *Bloody Urine*.—A sanguinolent state of the urine is sometimes observed, but not as frequently as we might, at first sight, be led to suppose. It is more common in the old and middle-aged than in the young, and is often directly traceable to the effects of exercise, as walking, jumping, or riding. The immediate cause of

this symptom is the friction which the stone, under these circumstances, exerts upon the mucous membrane, thereby rupturing some of its minute vessels. The sanguinolent appearance may last several days; but, in general, it promptly subsides under the influence of the recumbent position and demulcent drinks. The quantity of blood effused varies from a few drops to as many drachms or ounces. In ulceration of the bladder, or when there is a fungous tumor, or a vascular excrescence in this organ, the extravasation may amount to a real hemorrhage. It is not unlikely that, in some of these cases, the blood is derived from the kidney.

11. *Incontinence of Urine*.—Incontinence of urine, not constant, or even frequent, but occasional, is another symptom of this disease. It may be produced by several causes, of which the principal are, first, the presence of an unusually large stone, filling nearly the whole of the bladder; secondly, a loss of power of the sphincter muscle; and, thirdly, the partial obstruction of the orifice of the urethra, by the intromission of the foreign body. The urine, in all these cases, may dribble away incessantly, or it may be detained for some time, and then pass off involuntarily.

12. *Prolapsus of the Anus*.—A very common symptom of stone in the bladder, is a protrusion of the bowel, occasioned by the severe straining to which the patient is subjected whenever he passes his urine. It is most frequent in young children and old men, but is also often witnessed in the adolescent and middle-aged. Persons of a weak, relaxed habit of body are most apt to suffer from it. I have noticed it, however, repeatedly, in robust, fleshy subjects, in children as well as adults. It makes its appearance at various periods after the development of the disease, and exists in different degrees, from the slightest eversion of the mucous membrane to the protrusion of a large portion of the gut. In confirmed cases, the prolapsion is liable to be attended, at every attempt at micturition, with a discharge of flatus, mucus, and even feces.

13. *Sympathetic Suffering*.—Observation has shown that pain and other disagreeable sensations, caused by irritation of the urethra, or neck of the bladder, are sometimes perceived at parts very remote from the seat of the disease. Thus, a patient has repeatedly been known to complain of severe pain at the extremity of the coccygeal bone, during the passage of a bougie. Dr. Marshall Hall¹ had a case in which a stone in the bladder caused spasmodic stricture of the sphincter muscle of the anus. The contraction was

¹ Diseases of the Nervous System, p. 389. London, 1841.

so great that the finger could hardly be introduced. The moment the calculus was removed the stricture ceased. Like effects have sometimes been experienced in the knee, heel, and foot. The presence of a stone in the bladder has occasionally produced similar phenomena. An English nobleman, who had a vesical calculus, suffered from pain in his arm, for which his professional attendants were for a long time unable to account. Upon introducing a sound, the true nature of the case was detected, the stone was removed, and the symptoms disappeared.

14. *Noise emitted by the Calculus.*—The patient occasionally hears the calculi knock against each other in the bladder. Covillard¹ refers to the case of a man who could feel the concretions, of which there were nine, shake in his bladder. Fabricius ab Aquapendente alludes to similar examples.² When the calculi are numerous, and of considerable size, the bladder capacious, and the movement of the body sudden and violent, such an occurrence is not impossible. Dr. Eve³ lithotomized a man, who, when sitting on the edge of a chair, experienced a sensation in the perineum similar to that caused by crushing a ball of snow. The bladder contained one hundred and seventeen calculi. Persons affected with hydrothorax often feel and even hear the water splash about in the chest. With regard to the bladder, these phenomena appear the less surprising, when we reflect that urinary calculi have been known, under some violent movement of the body, to strike each other so hard as to break into small fragments.

15. *Constitutional Effects.*—Finally, the constitutional effects of stone vary considerably in different cases, and under different circumstances. At the commencement of the disease, the general health, in the great majority of instances, is but little, if at all, impaired; this is particularly true of children, who, although suffering severe local distress, often retain their flesh and good looks in a remarkable degree, showing that their assimilative powers are in excellent condition. In some cases, however, the system feels the effects of the local mischief at an early period, and in the more advanced stages it rarely entirely escapes. Young men and old subjects usually suffer more than children. When the affection is simple, the constitutional symptoms are generally slight, compared with what they often are when it is complicated with serious lesion of the urinary organs, especially of the bladder and the kidney.

¹ Obs. Iatrocir. p. 44.

² Opera Chirurgica, p. 541.

³ Southern Med. and Surgical Journal for 1849.

Under such circumstances, the general health is commonly severely deranged; the patient is thin and wan; his countenance is expressive of deep distress; the pulse is small, frequent, and irritable; the skin is dry and husky, and exhales a peculiar urinous odor; the surface is remarkably susceptible to external impressions; the sleep is disturbed at night; the appetite is impaired; the stomach is harassed with sour eructations; the bowels are irregular; the urinary secretion is vitiated; and the extremities are constantly cold. When the disease exists in its worst form, the symptoms here enumerated become greatly aggravated; and the patient is gradually worn out by hectic irritation, accompanied by night-sweats and colliquative diarrhoea. The duration of the disease, from its commencement to its final termination in death, varies in different cases, and under different circumstances, from eighteen months to ten, fifteen, twenty, and even thirty years.

The symptoms of this disease, after having, perhaps, existed for a long time in an aggravated form, are occasionally completely arrested, or so much mitigated as to induce the patient to believe that he is well. The pain diminishes, micturition is rendered more easy, and the general health decidedly improves. In this way the case progresses for weeks, perhaps, indeed, for months, when all of a sudden, in consequence, it may be, of exposure to cold, or some irregularity of the diet, the disease returns with its wonted violence; the urine assumes a turbid, purulent, or lactescent aspect; fever sets in; the tongue is covered with a whitish fur; the digestive function is disturbed; the face becomes pale and wan; rapid emaciation takes place; and death at length relieves the poor patient of all his troubles. In other cases, the symptoms recur in a very mild form, and the patient lives for years in comparative comfort. The causes of these changes are seldom appreciable.

SECTION VI.

PHYSICAL SIGNS—SOUNDING—DIAGNOSIS.

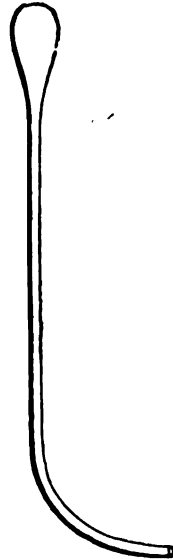
When the symptoms above described are all present, or even when several of them are absent, there is a strong probability that the patient is laboring under stone of the bladder, and this probability is converted into certainty, when the surgeon is able to feel and hear the foreign body. Nevertheless, as will be subsequently seen, cases occasionally occur, in which, notwithstanding the existence of both the rational and physical signs, no concretion is to be

discovered. On the other hand, a stone may apparently have been detected, and yet when the patient comes to be cut, no stone is found. Instances of both these occurrences have been repeatedly met with, and that, too, in the hands of the most experienced and accomplished lithotomists. It will be my duty, therefore, to point out in the present chapter, in as clear and summary a manner as possible, the principal sources of these errors.

From what has been just stated, it is evident that no conscientious or enlightened surgeon would ever think of performing the operation of lithotomy unless he is fully convinced of the existence of a calculus. To remove, therefore, all doubt upon the subject, no matter how clearly marked may be the rational symptoms, it is always necessary, as a preliminary step, to resort to *sounding*. This consists in introducing into the bladder an instrument shaped like a catheter, and either solid or hollow, with which the cavity of the organ is explored in every possible direction, and in the most patient, thorough manner. The instrument itself is called a sound.

Sounds vary in their construction, in their size, and in the materials of which they are composed. The best are solid, well polished, and made of steel, with varying degrees of curvature. For an adult, the length, from one extremity to the other, should be about twelve inches, of which two inches and a half should be allowed for the handle (Fig. 99). Children, of course, require a shorter instrument. Generally speaking, a sound of moderate diameter is preferable to one of large size, as it does not distend the parietes of the urethra, and is consequently much more easily moved about in the bladder. The vesical extremity, or beak, should be rounded off, not conical, or pointed, otherwise it will be liable to be arrested by the irregularities of the urethra, by the orifices of the prostatic and ejaculatory ducts, and by the folds of the bladder. The curved portion should not, as a general rule, exceed three inches, and should form an angle of about 45° with the straight portion. If the curved part is too long, too acute, or too obtuse, it will be more difficult to bring the point of the instrument in contact with the foreign body, especially when this happens to lie in the *bas-fond* of the bladder, and to move it about with that degree of freedom which is so necessary when we

Fig. 99.



wish to make a thorough exploration of the entire reservoir. For the same reason, it is hardly ever advisable to use a straight sound. The handle of an adult sound should not be less than two inches in length, by one inch and an eighth in width; it should taper somewhat towards the stem of the instrument, be about one line in thickness, rounded off at the corners, and well polished. Every lithotomist should be provided with several sounds, of various sizes and curvatures.

Some lithotomists prefer the ordinary silver catheter to the instrument now described, on the ground that it is more convenient when it is necessary to inject the bladder or draw off the urine. This is undoubtedly an advantage, which is not compensated, however, by the disadvantages of the more obscure noise and sensation, which such an instrument yields from its collision with the calculus. The gum-elastic catheter is unworthy of reliance, and should never be used by any one who has a proper respect for his own credit, or for the welfare of his patient.

Previously to sounding, the bowels should always be well cleared out with castor oil, or a purgative enema. A full rectum, by pressing upon the bladder, must necessarily tend to impede the movements of the instrument, and may, especially when it contains hardened lumps, even impart deceptive sensations to the hand of the surgeon. Such a condition will also interfere, more or less, with the introduction of the finger into the anus, and its play in the distended gut.

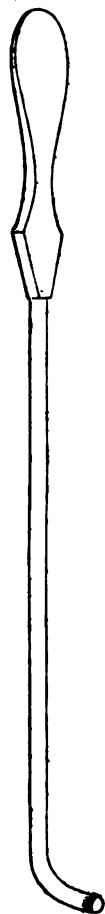
A patient is never sounded when the bladder is empty. In this condition the organ is apt to contract upon its contents, and may so prevent the instrument from moving about with that freedom which is so necessary for detecting the stone. The quantity of water which the bladder should contain must vary according to circumstances, as the capacity of the organ and the size of the concretion; but, in general, it need not exceed three or four ounces. If the urine is too abundant, there is danger that the stone, especially if it be small, will be lost in the fluid, and thus elude the sound. I have repeatedly met with cases where the bladder was so irritable as to be hardly able to retain any urine, even for a few minutes. Under such circumstances, and also where the patient has urinated inadvertently, the requisite distension should be produced by the injection of tepid water, through a silver catheter, which may then be used as a sound, care being taken to stop its orifice, to prevent the regurgitation of the fluid.

a. Operation.—During sounding, the patient should lie upon his

back, on a sofa, near the edge of the bed, or upon the floor, with his head and shoulders somewhat elevated, and the lower extremities slightly flexed and separated, to relax the abdominal muscles. Adults are sometimes sounded in the erect posture; children never, except under particular circumstances. The surgeon comports himself precisely as in catheterism. He takes his position at the left side of the patient, either sitting, kneeling, or standing, as the case may be, warms and oils the instrument, and introduces it in the same manner, and with the same precautions as when he draws off the urine.

Frequently the sound encounters the stone the moment it enters the neck of the bladder; but should this not happen, it must be passed further in, and moved about in different directions until the object is accomplished. To explore the lateral parts of the bladder, the instrument must be rotated upon its axis, first on one side, and then on the other. The *bas-fond* of the organ is best examined by holding the sound at a right angle with the body, and the superior portion or fundus, by depressing it between the thighs. The anterior or pubic surface of the bladder can be reached only by an instrument with a very long curve, not unlike that of an English S. Very frequently the stone cannot be felt, in consequence of its lying in a pouch in the *bas-fond* of the organ, just behind the prostate gland. When this is the case, the index finger of the left hand, properly oiled, is introduced into the rectum, and the foreign body pushed forward from its lurking-place against the sound. When the difficulty is very great, an instrument with a short, abrupt curve may be used, such as that sketched at Fig. 100. Sometimes it is necessary to change the position of the patient, making him lie on his side, sit or stand, bend forward, or raise his buttocks. Dr. Physick occasionally placed his patients nearly on their head, so as to render the fundus of the bladder the most dependent portion of the viscus. Indeed, every variety of expediency is sometimes required to enable us to accomplish the object of this preliminary operation. Children often greatly embarrass us by their cries, as well as their struggles. These sources of annoyance may, however, be pretty effectually counteracted at the present day, by the use of chloroform, which I

Fig. 100.



am in the habit of employing in nearly all cases of the kind, both for the purpose of preventing pain, calming the patient's mind, and quieting the bladder.

The noise and sensation communicated by sounding are peculiar. The noise is a sort of *click*, or clink, clear metallic resonance, if it may be so called, which is caused by the collision of the stone and the instrument, and which the contact of no other bodies in the bladder can produce. It is, therefore, peculiar, and hence in the highest degree valuable as a diagnostic sign. It may often be perceived at a distance of several yards from the patient, and is generally more distinct when the stone is hard and of moderate size than when it is very small or unusually large. The sensation communicated to the hand is likewise liable to considerable diversity. When the calculus is diminutive, it is generally proportionably faint, and indicative of a want of resistance on the part of the body touched; if, on the other hand, the concretion is large or of medium bulk, the instrument, in encountering it, receives a sort of shock which is rapidly and forcibly communicated to the hand, and is so characteristic that it can never, when once perceived, be mistaken. A grating, rubbing, or friction sensation is sometimes distinguished; but this is rather indicative of a fasciculated state of the bladder, of the existence of a morbid growth, or an incrustated condition of the mucous membrane, than of the presence of a calculus.

b. Danger of Sounding.—Patients are often brought to the surgeon from a distance to be lithotomized. When this is the case, they should not be sounded until they have recovered from their fatigue. Nor should the operation be performed during or immediately after a “fit of the stone.” Indeed, simple as the operation is, it should never be resorted to without due consideration. If it is important, as it is universally acknowledged to be, to prepare the system for the operation of lithotomy, it is hardly less so, in my judgment, to prepare it for that of sounding. From neglect of this precaution, patients are often subjected to much suffering, and even to great risk. Indeed, there is reason to believe that life has been repeatedly sacrificed in this way. Bad consequences occasionally follow, even when the utmost care is taken. In 1844, I sounded a young man who had been tortured for twenty-four years with stone in the bladder, attended with chronic cystitis, and great disorder of the general health. The operation was performed with all possible gentleness, and yet three weeks elapsed before he was sufficiently recovered to justify the performance of lithotomy. Severe

cystitis ensued, accompanied with violent spasm of the bladder, and the bowels became tympanitic and exceedingly tender on pressure, evincing the existence of peritonitis. These symptoms gradually yielded to the ordinary antiphlogistic remedies, but not without inducing the belief, at one period, that the patient would perish.

The sounding should always be conducted with the utmost gentleness, and should never be continued beyond a few minutes at a time. A protracted operation of this kind is generally productive of mischief, and cannot be too pointedly condemned. Should severe pain ensue, it must be allayed by a full anodyne; and any inflammatory symptoms which may arise are to be combated by the usual remedies. In all cases, the patient should be directed to make free use of demulcent drinks.

Mr. Fletcher¹ relates the following interesting case, in which this operation proved fatal. A healthy boy, six years old, was brought to a hospital with symptoms of stone, for which he was twice sounded by the surgeon, who satisfied himself, on both occasions, of the existence of the disease. On the day, however, appointed for the operation, he could not detect it, and several of his friends tried successively, with no better success. The surgeon at length put a stop to these proceedings, but his interference was too late. The boy was put to bed, complaining that his belly ached. Active peritoneal inflammation followed; and, notwithstanding the most energetic means to control it, death took place on the fourth day after the sounding. The inner membrane of the bladder was spotted deep-red everywhere, and its peritoneal coat was glued to that of the intestines, which were on all sides inflamed and covered with lymph.

Mr. Crosse² says: "In consequence of persevering and unsuccessful attempts to discover a stone with the sound, in a little boy, inflammation of the bladder came on, attended by vomiting, and extending to the peritoneum; the most active antiphlogistic treatment failed to arrest it, and death ensued in four days." Sanson, Civiale, and other surgeons, allude to similar instances, in some of which death appears to have been produced by injury inflicted, in sounding, upon the urethra, prostate gland, or neck of the bladder.

Professor Horner³ mentions the case of a man, fifty years of age, who died of violent inflammation of the bladder, accompanied by peritonitis, in less than three days after he was sounded.

¹ *Medico-Chirurgical Notes and Illustrations*, p. 89.

² *Essay on Urinary Calculus*, p. 48.

³ *A Treatise on Pathological Anatomy*, p. 198.

Death in these cases does not always occur immediately after the operation, but as a kind of secondary effect. Thus, in an instance recorded by Mr. Skey,¹ it took place two months after the operation, in consequence of disease of the kidney. The stone, which was large, was readily seized with the lithotripsy forceps, but no attempt was made to break it. The examination was carefully repeated at the end of a fortnight, when it was followed by intermittent fever and pain in the bladder, causing death in the manner just mentioned.

c. Auscultation.—When the stone is uncommonly small, or the feel and noise elicited by the contact of the sound are very feeble, recourse may be had to auscultation, as was long ago proposed, in cases of this kind, by Laennec. This may be done by applying the stethoscope either to the pubic region, to the sacrum, or to the perineum, or to all these points successively; at the same time that the sound is moved about in the bladder in different directions, as in the ordinary method. By adopting this procedure, it will hardly be possible, if the instrument happen to touch the stone, not to distinguish some noise. As air is a better conductor of sound than liquids, Dr. Ashmead, of Philadelphia, proposed, many years ago, as a preliminary step, to draw off the urine, and substitute this fluid; a sufficient quantity to distend the bladder being thrown in by means of a syringe. The suggestion, although ingenious, has not been carried out by lithotomists, chiefly, perhaps, because it is troublesome of execution, and because few operators would be willing to cut a patient, in whom the existence of the calculus is so equivocal. It has been lately proposed to perform vesical auscultation by attaching the stethoscope to a silver catheter. From the experiments of Velpeau, Ludgere, and others, it would seem that the noise, produced by the collision of the instrument against the stone, is most distinct when the exploration is conducted in this manner. My own observations have satisfied me of the correctness of the result obtained by these gentlemen. Nevertheless, I must confess, I should be indisposed, under any circumstances, to place much confidence in this mode of diagnosis. I should hardly feel at liberty to cut my patient's bladder, if I had no better or more satisfactory evidence of the existence of the stone than what was derived from auscultation, whether executed in the ordinary way, or as suggested by Ashmead, or as practised by Velpeau and other surgeons.

It is important for the surgeon to be aware, in practising vesical

¹ *Operative Surgery*, p. 497. Philadelphia, 1851.

auscultation, that, when the bladder is perfectly empty, the instrument, as it is moved backwards and forwards over the mucous membrane, occasions a friction sound, like that of the working of a pump. If, on the contrary, the organ contains a small quantity of urine, "a gurgling sound results, similar to that which is produced by chewing the saliva between the teeth when the mouth is closed."¹ Lisfranc ascertained, many years ago, that pieces of flesh introduced into the bladder, and struck with the sound, do not yield any noise. This fact is of no little value in regard to the discrimination between a fungous growth of the bladder and a calculus of this organ.

d. Evidence furnished by the Sound, in regard to the Volume, Situation, and Number of Calculi.—Sounding enables us not only to detect the presence of a calculus in the bladder, but it frequently furnishes important data in regard to its bulk, situation, and consistence, and as to whether it is single or multiple, rough or smooth, loose or attached.

It is usually not very difficult to form a tolerably correct idea of the *volume* of a stone. If it is easily pushed about by the instrument, and lost, as it were, in the midst of the water, it may be inferred that it is small; on the contrary, it may be concluded that it is quite bulky, if it maintains its position under the action of the sound, or if it can be touched simultaneously at a number of points, or, what is the same thing, if it presents a large surface. The noise furnished by the shock of the instrument will also afford valuable information. Small concretions emit a fainter sound than large ones, and the harder varieties, as the oxalic and uric, than the phosphatic and ammoniaco-magnesian, which are comparatively soft. A big calculus is always easily felt by the finger in the rectum; while a small one is either not perceived at all, or only in a very imperfect manner.

It has been proposed, where greater accuracy in regard to the volume of the calculus is desired than can be obtained by the more common methods of exploration, to employ a particular instrument marked by the divisions of the *mètre*. For this purpose a common lithotrite might be used, or the contrivance of Dr. L'Estrange, constructed upon the same principle. A similar instrument has been recently invented by Dr. Fleming,² of Dublin, for measuring concretions in the bladder of children. Nothing, it appears to me, can be more unscientific than such attempts, which, to say the least, are

¹ Laennec's *Treatise on the Diseases of the Chest*, p. 719. New York, 1830.

² *Dublin Quarterly Journal of Medical Science*, vol. xviii. p. 257. 1854.

not always free from danger. To grasp a stone in the bladder is not always an easy operation, especially to one unaccustomed to its performance; but to measure it in its different diameters, and then disengage it from the instrument, must often be extremely difficult, if not impossible. In many cases, moreover, the bladder must be quite intolerant of such manipulations; or, where tolerant in the first instance, resent the injury at a more remote period, just as frequently happens after rough and protracted efforts at sounding. In children especially, such a proceeding is unnecessary, because it may be assumed, as a general rule, that the calculus is small, and that it will admit of easy extraction through an opening of reasonable size in the perineum. In adults, the history of the case, and the mode of exploration previously described, will generally suffice to put the operator in possession of the requisite information, without a resort to particular instruments.

In trying to ascertain the *situation* of a stone in the bladder, important aid may be derived from the introduction of the finger into the rectum, or vagina. Indeed, this can, in many instances, be done in no other way. My invariable plan is, when I sound a patient, to resort to this expedient. In old subjects, in which the calculus frequently lodges in a cul-de-sac just behind the prostate gland, its presence can hardly be detected without it. In children, too, it is a most valuable auxiliary. The pelvis, at this age, is usually so short and narrow that nothing is more easy than to trace the whole outline of the infero-posterior portion of the bladder, enabling us frequently at once to determine not only the situation of the concretion, but also whether it is loose or fixed, small or large, single or multiple. When there is reason to suspect that the stone is situated in the fundus of the bladder, or just behind the pubes, it might, especially if it be large, and the bowels are perfectly empty, be possible to detect it with the hand, applied to the lower part of the hypogastric region.

The *noise* furnished by the instrument enables us sometimes to determine pretty accurately the consistence, structure, and chemical qualities of the foreign body. The uric and oxalic calculi, as previously stated, emit a clear sound, clink, or click; the phosphatic, a flat sound; and the ammoniaco-magnesian, a sound intermediate between the two.

By carrying the sound into different parts of the bladder, we may ascertain whether there is but one stone or whether there are several, and even form a tolerably correct idea of their actual *number*.

When several coexist they are usually small, and the sound, upon striking them, produces a sort of clashing sensation, attended with a rattling noise.

The stone may be supposed to be *smooth*, when the sound, brought in contact with its surface, glides easily over it, without being impeded in its progress. If, on the contrary, it is rough, spinous, or tuberculated, the point of the sound is liable to become arrested, and may thus impart a grating sensation to the fingers. It has been already stated that the multiple calculi are nearly always smooth, and the single more or less rough.

We judge that the stone lies *loosely* within the bladder, when it changes from time to time its position, or migrates, as it were, from one part of the organ to another. An encysted or adherent stone is always found in the same situation, due allowance being made for the alterations of form, which the bladder undergoes from the presence or absence of the urine.

c. Errors of Sounding.—Although sounding is the only certain method of detecting a stone in the bladder, it is occasionally liable to error. Numerous cases are upon record where a foreign body was supposed to be present, and where the poor patients were subjected to all the pains and perils of lithotomy, and yet no calculus was found, either at the time of the operation or after death. Surgeons of the most consummate skill and the most extensive experience have fallen into this error. It is for the purpose of avoiding a repetition of such mistakes, so discreditable to those who commit them, that I shall endeavor briefly to point out their sources. Great men may sometimes commit an error with impunity, which would bring ruin and disgrace upon a more humble member of the profession. Cheselden,¹ the most celebrated lithotomist of his age and country, cut three patients without finding any stone. Blanc,² Dupuytren,³ Roux,⁴ Crosse,⁵ Tyrrell,⁶ Cotta, and Vacca,⁷ all operated, expecting to find a stone, where there proved to be none. The late Dr. Physick⁸ came very near committing the same mistake. He

¹ Benjamin Bell's System of Surgery, ii. p. 40. Edinburgh, 1784.

² Desault's Chirurgical Journal, translated by Gosling, i. p. 125. London, 1794.

³ Leçons Orales, t. ii. p. 334.

⁴ Johnson's Medico-Chir. Rev. April, 1827, p. 549.

⁵ Essay on Urinary Calculus, p. 50.

⁶ Dublin Quarterly Journal of Med. Science, vol. xiv. p. 462. 1852.

⁷ London Lancet, vol. i. p. 28. 1845-6.

⁸ Liston's Practical Surgery, by Norris, p. 310. Philad. 1838.

sounded a patient, and had no doubt there was a stone. His health, however, was bad, and the operation was postponed. He died some time after, and upon examination no stone was found.

Mr. Crosse,¹ who, as we have just seen, was himself unfortunate in one instance, states that he has notes of not less than eight cases in which the operation was needlessly performed, and to several of which he was an eye-witness. The late Mr. Samuel Cooper,² of London, was acquainted with the particulars of at least seven such cases, at two of which he was present. Velpeau³ says he has a knowledge of four instances, where the patients were subjected to the operation without there being any calculi in the bladder. South⁴ mentions the case of a child, two years and a half old, who was cut for stone, but in whom no stone was found, although he had suffered very severely, and a calculus was supposed to have been felt. I am acquainted with two instances in which the patients were lithotomized without there being any stone. One of these was a child, under four years of age, whose parents resided in Indiana. He was sounded several times, and a stone was supposed to be present, but none was found at the time of the operation. He recovered quickly, and is still living. The other case occurred in Kentucky, in an old man, upwards of sixty years of age, who was cut by the same surgeon, under the supposition that he had calculus. He died a few days after the operation, and, upon examination, the bladder was found to contain nothing but a fungous tumor, portions of which had repeatedly come away by the urethra during life. My friend, Dr. George Blackman,⁵ of New York, while in Europe in 1853, witnessed an operation by a hospital surgeon, where, although the patient was kept an hour upon the table, no stone was found. Many similar examples are recorded in the *Mémoires de l'Académie de Chirurgie* of Paris. It is worthy of remark that quite a number of the patients in whom no stone was found were promptly and entirely relieved of the symptoms which had been attributed to its presence. On the other hand, it is equally certain that some of them perished from the effects of the operation, while others who survived it received no benefit from it.

The circumstances which may lead to the commission of the error

¹ Essay on Urinary Calculus, p. 50.

² Dictionary of Surgery, vol. ii. p. 134. New York, 1842.

³ Operative Medicine, vol. iii. p. 891.

⁴ Chelius's Surgery, South's edition, vol. iii. p. 277.

⁵ MS. Letter to the author.

above mentioned differ very much in their character, and are dependent for their origin either upon the bladder itself, or upon the surrounding parts. The following are the most important.

I. In the first class are included an ulcerated, indurated, and contracted state of the bladder, the development of an osseous cyst, and the formation of a fibrous, encephaloid, or polypous tumor, and a deposit of tubercular matter.

(a.) One would hardly suppose that ulceration of the bladder could ever be mistaken for stone, and yet such an accident has actually occurred in the hands of a most able and accomplished operator. The case to which I allude was that of the late Mr. Tyrrell, surgeon to St. Thomas's Hospital, London. The subject was a young child, who, in addition to loss of strength and rapid wasting of the flesh, labored under the ordinary symptoms of stone in the bladder. He was sounded four times, and a calculus, with a rough surface, and probably of large size, was declared to exist. The operation was performed in 1836. No stone was found, but all the previous symptoms were relieved at once. The wound, however, never healed, and the little patient died in a hectic condition in the following February. It was ascertained, on dissection, that the anterior part of the bladder had been entirely destroyed by ulceration, and that there was not, anywhere, the slightest trace of healthy mucous membrane, the surface being uniformly broken and sloughy. The left kidney was converted into a large bag filled with pus, and matter was also contained in the left ureter and the cellular substance of the cavity of the pelvis.¹

(b.) A bladder in a state of induration, whether produced by a mere hypertrophy of its muscular coat, or a cancerous degeneration of its mucous and sub-mucous cellular tissues, may communicate such a sensation through the sound as to induce the belief that there is a calculus. We have already, in a previous part of this work, considered these lesions in sufficient detail, and it is not necessary, therefore, to do more than refer to them here. Cheselden was betrayed not less than three times by this condition of the bladder in the course of his practice, which was very extensive. Two of his patients were young subjects. Blanc,² a French surgeon, met with a similar occurrence in a child five years old, who had all the

¹ Travers, *Observations in Surgery*, as quoted by the *Dublin Quarterly Journal of Medical Science*, vol. xiv. p. 462. 1852.

² Desault's *Parisian Chirurgical Journal*, translated by Gosling, vol. ii. p. 125.

rational signs of an urinary calculus. The operation was performed, and death took place at the end of twenty-four hours. The bladder, which was free from stone, was very much contracted, and of a firm cartilaginous consistence, almost like horn, imparting, when touched with the sound, the sensation of a hard body. A fasciculated or sacculated bladder might be equally productive of deception.

(c.) Thirdly, the deception may be produced by an osseous cyst, situated in the bas-fond or some other portion of the bladder. An instance of this kind fell under the observation of Mr. Middleton,¹ of St. George's Hospital, London, in 1739. The patient was a negro fifteen years of age, in whom the symptoms of calculus were so well marked that no doubt was entertained respecting the nature of the disease. The stone was felt through the sound by a number of operators, among whom was Cheselden. The boy was lithotomized, but no calculus was found. Death occurred the next day; upon examining the body, it was discovered that the symptoms had been produced by a round, bony cyst, as large as a chestnut, situated at the posterior and lateral part of the bladder, and occupied by a hard, calcareous substance.

(d.) Another source of error may arise from the presence of a fibrous, fungous, or polypous tumor. Many cases of this kind are upon record, and it is incumbent upon the lithotomist to be aware of the fact. One, in which a bleeding fungus was mistaken for a calculus, is mentioned by Mr. Key, of London, in the second volume of *Guy's Hospital Reports*. The patient was sounded repeatedly by an experienced surgeon, and pronounced to have stone. Being placed under the care of a lithotomist, a day was appointed for the operation; but before this arrived, the man became ill, and died. No stone was discovered in the bladder, but, instead of this, a bleeding fungus of considerable size was seen, growing from the mucous membrane. In the case of a child eighteen months old, recorded by Mr. Crosse, in his *Essay on Urinary Calculus*, the error arose from the presence of a number of polypous tumors, which sprung from the inner surface of the bladder, and had been mistaken by the sound for a urinary concretion. Mention has been made of this singular case in another part of this work.

The sensation communicated by such growths through the instrument is, in general, remarkably faint, and strongly resembles that produced by striking a heart or liver. It is dull, flat, obtuse. No

¹ Deschamps, de la Taille, t. i. p. 281.

sound is emitted by the percussion, much less that peculiar click, or sharp, ringing, metallic noise, so characteristic of the presence of a calculus. There is, moreover, no change discoverable in the situation of the morbid product; on the contrary, it is always felt at the same spot, and the sensation which it imparts to the fingers of the examiner is the same, whether the bladder contains much or little fluid. I recollect, some years ago, repeatedly sounding an old gentleman, for what he and his friends supposed to be a stone. The instrument always promptly encountered the foreign body, but it never produced any noise, or hard feel, such as we are accustomed to perceive when there is a calculus. The consequence was that I declined to operate; a course in the propriety of which I was confirmed by the circumstance that the patient had, on various occasions, discharged small pieces of fungous matter, as well as blood, by the urethra. Becoming at length dissatisfied with me because I would not cut him, he placed himself under the care of another physician, who operated, but found no stone. Death happening a few days after, it was ascertained that the symptoms which had so long distressed him, and which had so strongly resembled those of calculus, had resulted from a fungous tumor in the *bas-fond* of the bladder.

Fungous, encephaloid, and vascular tumors of the bladder may be further distinguished from calculus by their liability to bleed from sounding, or rough exercise, and by the occasional discharge of pieces, shreds, or fragments of the morbid growth along with the urine. These appearances will, for obvious reasons, be more liable to occur in the advanced than in the early stages of the disease.

(e.) Tubercular deposits have, in at least one instance, led to a wrong diagnosis. Baron Dupuytren¹ cut a child, two years and a half old, who had for a considerable time labored under violent pains of the bladder. The foreign body was repeatedly touched with the sound, but occasionally the instrument failed to detect it. The operation was performed, but no stone was discovered. Death took place some time after, when the *bas-fond* of the bladder, near the orifice of the right ureter, was found to be studded with softened tubercles. Similar deposits existed in the lungs.

(f.) A singular cause of deception is mentioned by Foubert, a French surgeon.² In sounding a man, who was laboring under some urinary

¹ *Leçons Orales*, t. ii. p. 334.

² *Mémoires de l'Académie Royale de Chirurgie*, t. ii. p. 26. Paris, 1819.

disease, he was unable to traverse the *bas-fond* of the bladder, in consequence of the instrument being arrested by a hard, resisting body. He naturally inferred that he had struck a calculus, probably one of large size. The patient, however, died before he was operated on; and, on dissection, it was found that the foreign substance, which seemed to adhere to the *bas-fond* of the bladder, was nothing else than the summit of this organ, which had become invaginated, and thus formed a cavity on its outside, in which a portion of the small bowel was lodged.

II. In the second division of the subject may be comprised certain affections which involve the parts in the immediate vicinity of the bladder, as the prostate gland, rectum, uterus, vagina, and pelvic bones.

(a.) The prostate gland, as is well known, is very liable to enlargement, especially in old age, giving rise to symptoms which not unfrequently simulate those produced by stone in the bladder. When the middle lobe is hypertrophied, it forms a hard prominence just behind the neck of the bladder, which materially obstructs the flow of urine, and may readily communicate a deceptive sensation through the sound. In general, however, the impression is more faint than in stone, and the hypertrophied part is completely stationary, while in the latter disease the foreign substance is almost always movable. Another mark of distinction is that the enlarged organ may be felt distinctly through the rectum, just behind the neck of the bladder, as a hard, firm, and resisting body, the position of which it is impossible to change by any effort of the finger.

A case is mentioned by Mons. Ripault,¹ of Digon, in which the operation of lithotomy was performed, without any calculus being discovered in the bladder, although a metallic click had been elicited in sounding. The man died six months after the operation, and on opening the body, the prostate gland was found to be much enlarged, and of a hard fibrous structure. On striking it with the sound, a peculiar noise was produced, which had given rise to the belief of the existence of stone.

A small calculus embedded in the substance of the prostate has occasionally led to an erroneous diagnosis. Indeed, in several cases of this kind which have fallen under my own observation, the greatest circumspection was necessary to avoid mistake. The marks of distinction are, that the concretion is fixed in its situation, that

¹ London and Edinb. Monthly Journ. Medical Science for 1842, p. 871.

it is uncommonly small, and that it is always encountered the moment the extremity of the sound enters the bladder. The noise, moreover, emitted by the concretion is very faint, and a grating or rubbing sensation may be perceived by the finger in the rectum, very different from the noise and feel when there is a vesical calculus. When a number of prostatic calculi exist in a pouch or cyst, a distinct clashing may sometimes be produced by pressing them against each other, or between the finger and the sound.

(b.) A scirrhus, polypous, or fibrous tumor of the rectum, or an earthy concretion lodged there, might be mistaken for a stone in the bladder. One would hardly suppose that hardened and impacted feces would ever be a source of deception, and yet several well-authenticated examples of this description are upon record. Rutti¹ mentions an instance in which, although the sound seemed to confirm the existence of a stone in the bladder, no trace of anything of the kind was found after death. A mass of hardened excrements in the rectum had given rise to the mistake.

(c.) Error may arise from mal-position of the uterus. Lassus² records the following case. A female, supposed to have an encysted calculus in the bladder, underwent the operation of lithotomy. Death took place soon after; and, upon examination, the uterus was found to be situated across the pelvis, the mouth lying upon the middle of the rectum, and the highest portion of the body of the organ upon the bas-fond of the bladder, which it had thus thrust forwards and formed a tumor, which had been mistaken for an encysted calculus. The patient had experienced all the rational symptoms of the disease. Two similar cases are mentioned by Levet. A foreign body, as a pessary in the vagina, or a scirrhus tumor of the inferior extremity of the uterus, might lead to mistake.

(d.) An exostosis of the pelvic bones may be another source of mistake. All these bones are more or less liable to this kind of morbid growth, which sometimes acquires such a magnitude as to encroach very seriously upon the pelvic viscera, impeding the flow of urine, and the descent of the child's head during parturition. When the exostosis is situated on the sacrum, the inner surface of the ilium, or behind the pubes, and the patient is at the same time affected with an irritable state of the bladder, with frequent and painful micturition, the case might be easily enough mistaken for

¹ *Traité des Voies Urinaires*, p. 25.

² *Méd. Opér.* t. i. p. 315.

one of stone. The rational symptoms of the malady being present, it is only necessary that the sound should strike against the tumor, to convince a young or an inexperienced lithotomist, anxious for the eclat of an operation, that his patient has a vesical calculus.

(e.) Error in diagnosis has been caused, in at least one instance, by disease of the hip-joint, attended with protrusion of the head of the thigh-bone into the bladder. It occurred, many years ago, at Brussels, in a man who had all the symptoms of stone. Mormeaux, an eminent lithotomist, cut him, and, introducing the forceps, seized what he supposed to be an enormous calculus, but which he in vain endeavored to extract, for it was as immovable as a rock. Death taking place a short time after, it was discovered that the head of the thigh-bone, in consequence of a fall received several years previously, had penetrated the acetabulum, and had become incrustated with a thick layer of calcareous matter; whence the error of the surgeon.¹

(f.) Finally, the mistake under consideration may be occasioned by an unusually projecting sacrum, in a very narrow pelvis, affording resistance to the sound, and inducing the belief that there is a vesical calculus. Such a case is mentioned by Mr. Crosse,² and I am satisfied that the error has occurred much more frequently than is generally supposed. This condition of the sacrum and pelvis is most common in male children, under five years of age. Distortion of the bones of the pelvis, by which the cavity of this name is greatly diminished in size, might lead to an error of diagnosis, in the same manner as when there is an exostosis.

f. A Stone may be present, and yet not be detected by the Sound.—It is well known that there may be a stone in the bladder, and yet the surgeon be unable to detect it by sounding, aided, perhaps, by all the auxiliary means he can command. This failure has frequently occurred, even where the concretion has been uncommonly large, and where the operation has been repeatedly performed with the greatest care and skill, and varied in every possible manner. Want of success has sometimes attended, even where the calculi were multiple, or where a considerable number coexisted. Again, it has happened that a stone has been promptly detected in a first sounding, and perhaps not at all, or only after much trouble in a subsequent one. Or the reverse of this may occur, that is, the

¹ Dr. Uytterhoeven, *Archives de la Médecine Belge*, t. vii. p. 44, 1842.

² *Essay on Urinary Calculus*, p. 50.

cretion may elude the instrument in a first and second sounding, but be always readily detected afterwards. It is with sounding as with everything else. To perform it well requires great tact in the use of instruments, a perfect knowledge of the anatomy of the urinary apparatus, and a degree of experience which multiplied observation alone can supply. But the want of success, in this operation, is not confined exclusively to the young, the ignorant, or the unskilful. Men of the most consummate dexterity have occasionally failed in detecting a stone, when a stone really existed. I recollect a case, illustrative of the present subject, which occurred many years ago, and which made a strong impression upon me at the time. Mr. Harding, an elderly gentleman, of Philadelphia, and a captain in the merchants' service, had labored for several years under all the rational symptoms of stone in the bladder. As he made frequent voyages to Liverpool, he determined, on one of these occasions, to visit London, for the purpose of submitting his case to Mr. now Sir Benjamin, Brodie. A most thorough exploration of the bladder was made by this gentleman, so distinguished for his knowledge of urinary diseases, but no stone was found. Upon his return to America, Captain Harding lost no time in consulting the late Dr. Physick, who lived within less than one hundred yards of his own residence. A calculus, of considerable size, was promptly detected by the sound, and a few days after removed by the lateral operation. These facts were communicated to me, upwards of twenty years ago, by Captain Harding himself, who was a very respectable and intelligent man.

Numerous circumstances may interfere with, or entirely prevent, the detection of a vesical calculus; and hence it may become necessary to examine a patient not merely *once*, but perhaps many times, before we are justified in giving a definite and final opinion respecting the nature of the case. It would certainly, to use the language of my friend, Dr. Blackman,¹ seem to be the part of sound discretion, if, after having carefully searched the bladder, we find no stone, to adopt the injunction of Van Swieten, who says, "*nunquam pronuntiabat calculum non adesse, sed simpliciter affirmabat se non invenisse calculum.*"

Of the circumstances which may prevent the detection of urinary calculi, some relate to the stone itself, some to the bladder, and some to the neighboring and associate organs. The subjoined arrangement comprises the most important of these causes.

¹ New York Journ. Med. and Surg. January, 1852, p. 118.

I. Obstacles dependent upon the calculus itself.

(a.) The stone may be unusually small, in which case it will not only be more difficult to detect it, but, when found, it will be more liable, if such an expression may be used, to jump away from the instrument, and so elude its contact. The sound emitted by it will also be proportionably faint and indistinct.

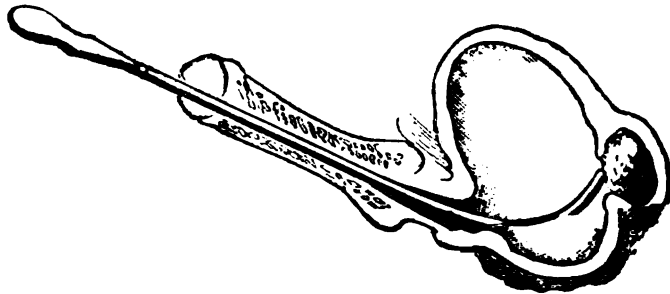
(b.) The concretion may not only be diminutive, but it may be coated with a layer of lymph or inspissated mucus, so that the instrument shall glide over it without receiving from it the customary impression.

(c.) A very bulky stone, without exhibiting anything peculiar in other respects, has sometimes eluded the sound. The principal reason of this is the situation of the foreign body in a dependent or unusual part of the bladder, the size and form of the instrument, or the manner of conducting the exploration.

II. Obstacles connected with the bladder.

(a.) The calculus may be encysted, or contained in a particular pouch, formed by the protrusion of the mucous membrane across the muscular fibres of the bladder. (Fig. 101.) In this case, the foreign

Fig. 101.



body lies virtually on the outside of the urinary reservoir, within the pelvic cavity, and may be so protected by the thickened parietes of the organ as to render its detection utterly impracticable by the most careful sounding. In an instance mentioned by Mr. Nourse, in the forty-third volume of the *London Philosophical Transactions*, the calculi, nine in number, and contained in six separate cysts, were detected in the first sounding, but never afterwards. Ellerus relates a case in which a stone existed between the coats of the bladder.¹

¹ Morgagni, *Seat and Causes of Diseases*, vol. ii. p. 354.

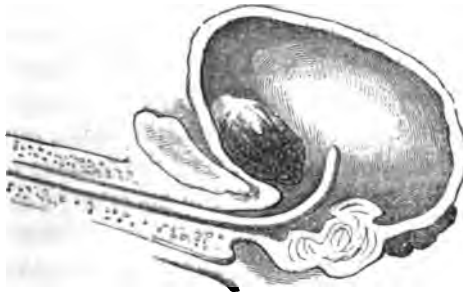
(b.) In many cases, especially in aged subjects, a pouch, hollow, or cul-de-sac, exists in the bas-fond of the bladder, immediately behind the prostate gland, in which the calculus may lie secure from the sound. (Fig. 102.) The proper method for dislodging the concretion, when thus hid, has been already pointed out.

Fig. 102.



(c.) The stone sometimes lodges in front of the bladder, just behind the pubes, either in a cyst, pouch, or cul-de-sac, as in Fig. 103. When this happens, it will be difficult, if not impossible, to reach it, unless

Fig. 103.



the instrument is unusually long, its curve uncommonly great, and its handle inordinately depressed between the patient's thighs.

(d.) The urinary bladder may be bilobed, or divided by a kind of diaphragm into two compartments, the upper of which may contain a calculus, which no sound, however shaped or managed, may be able to reach or detect.

(e.) When the urinary bladder escapes into the groin, as it does in certain forms of hernia, it may contain a stone which no sounding, however skilfully conducted, can discover. In a case of this de-

scription, recorded by T. D. Sala, the patient had all the symptoms of stone, but no stone could be felt during life. After death, it was found in the bladder, which had passed into the groin. Pott¹ gives a similar instance. The patient was a boy thirteen years of age, and the stone was removed by incision from the groin, where it had been confined in a firm, strong, white cyst, connected with the bladder. Urine passed by the wound for several weeks, but the cure was completed in a month. In the female, the bladder sometimes passes into one of the great lips. Hartmann² met with a case of this kind in which the protruded part contained a stone weighing three ounces.

(f.) A stone, especially when small, may be temporarily lost in the folds of the bladder, and so elude the sound. When this organ is fasciculated, the foreign body might be arrested permanently in one of the depressions or cavities which are so frequently met with under such circumstances. A stone so imbedded would be likely to remain small, and burying itself, as it were, beneath the hypertrophied muscular fibres of the bladder, would impart through the sound a very faint and imperfect sensation to the hand.

(g.) The bladder may contain too much or too little water. In the former case, unless the stone is of considerable size, it will be difficult to touch it, or, if struck, to obtain the characteristic feel and click. It will fly before the instrument, and be lost in the midst of the fluid. If, on the other hand, the quantity of urine is very small, the bladder, by contracting forcibly upon the concretion, may hold it firmly in its grasp, and so prevent it from being satisfactorily felt and heard. In such a case, moreover, the stone, especially if it be small, may be concealed in the folds of the mucous membrane.

(h.) Finally, the surgeon may fail in his attempt to feel the stone, in consequence of an immense accumulation of blood or inspissated mucus in the bladder. From the same causes, especially the latter, the pain arising from the presence of the concretion may become materially mitigated, particularly if the adherent mucus is very thick, or intermingled with coagulating lymph.

III. Obstacles arising from the neighboring organs, as the ureter, prostate gland, and urethra.

(a.) The stone may elude detection in consequence of an enormous dilatation of the ureter. The sound may move about in the abnormal

¹ *Chirurgical Works*, vol. ii. p. 397. Phila. 1819.

² *Eph. Nat. Cur. Ann.* v. obs. 71.

pouch with the same freedom nearly as in the bladder, in which the calculus is contained, but which the instrument fails to enter. Such a contingency, although very infrequent, has been several times encountered in practice.

(b.) The prostate gland, excavated by disease, as an ulcer or an abscess, may occasionally conceal a small calculus so as to prevent it from being touched by the sound, or felt by the finger in the rectum. When there is reason to suspect such a condition, the proper mode of proceeding would be to use a sound with the slightest possible curve, and to push the calculus out of its bed by inserting the finger into the bowel.

The prostate gland is sometimes converted into an immense pouch, in which the end of the sound may be arrested, without detecting any stone, instead of passing into the bladder, where the foreign body is actually situated. Müller,¹ a German writer, mentions the case of a boy, eight years of age, in whom such a lesion led to this mistake. He was sounded twice without any stone being discovered. The third time, however, it was detected, and the operation was accordingly performed; a large quantity of pus escaped, but no calculus was found. The patient died, and on dissection it was perceived that the bladder had been converted into a fleshy mass, contracted tightly round a concretion of the size of a small lemon. The prostate was partly destroyed by suppuration, and presented an enormous cavity into which the instrument had wandered during sounding, and which had been mistaken for the bladder. A similar case is mentioned by Civiale.²

(c.) Another source of error is the introduction of the sound into an abnormal pouch of the urethra. This affection, although infrequent, occasionally exists, and may lead to deception. Pelletan,³ an eminent French surgeon, saw two cases which were mistaken in this manner; in one the stone was about the size of a pullet's egg; and in the other, a child seven years of age, it nearly filled the bladder.

g. The Symptoms of Stone may be simulated by sympathetic irritation.—The irritation which gives rise to this embarrassment may be situated in the urinary organs themselves, or in the neighboring viscera. The following remarks and observations will place this subject in a more distinct light.

¹ Diss. Raram de Calc. Vesic. Observat. Continens, p. 17.

² Traité de l'Affecton Calculeuse, p. 485. Paris, 1838.

³ Ségala, Essai sur la Gravelle et la Pierre, p. 155, sec. edit. Paris, 1839.

The symptoms may depend upon an *irritable bladder*. Of this occurrence, every surgeon, at all extensively engaged in practice, must have witnessed examples. I have seen quite a number, and have often experienced no little embarrassment in making out the diagnosis. I subjoin the following case as a type of a thousand others, and because it produced, at the time, no inconsiderable share of notoriety in the neighborhood in which it took place.

Oliver B——, a tall, well-grown boy, three years and a half old, a resident of Tennessee, had been laboring, for upwards of eighteen months, under what were supposed to be symptoms of vesical calculus. He had a frequent desire to pass his water, accompanied with spasmodic pain at the neck of the bladder, and occasional interruption of the stream of urine. His sufferings, though liable to occur at any period, were usually most severe towards evening, and often lasted two or three hours at a time. He had been sounded repeatedly by an intelligent physician of the neighborhood, who was convinced that he both felt and heard the calculus.

At the request of the father of the child, backed by the assurance of the family physician that there was no doubt about the nature of the case, I was induced, early in April, 1844, to visit the little patient at a distance of upwards of two hundred miles from my residence. On my arrival, I found the boy quite fleshy and in fine health, with a good appetite and ruddy complexion, able to exercise about the premises, and enjoying sound sleep at night. He had had but one paroxysm, and that a very slight one, of difficulty in urinating for the last six weeks. This was about a fortnight before my visit, and instant relief was afforded by passing a catheter down to the bulbous portion of the urethra. It is proper to observe that, during the above period, the boy had, at my suggestion, made free use of uva ursi and hop-tea, with bicarbonate of soda, that his diet consisted chiefly of bread and milk, and that he took occasionally a hip-bath.

The bowels having been thoroughly evacuated, I sounded the little patient the morning after my arrival, but found no stone, although the operation was unduly protracted, and the instrument moved about in the bladder in every possible direction. All that could be detected was a roughness in the prostatic portion of the urethra, apparently at the right side of the gallinaginous crest. When this part was touched by the instrument, it emitted a faint, dull sound, and imparted a slight grating sensation, easily recognized by the finger in the rectum. The operation was repeated the next

day, but with no better success. The roughness, however, was again felt and even heard. During both these examinations, I took care to vary the posture of the patient; I had also my finger several times in the rectum, moving it about from side to side, and carrying it as high up as the promontory of the sacrum, which I could feel distinctly; I was assisted, on both occasions, by several physicians of the neighborhood. Of course I declined to operate. The boy was subsequently sounded by Dr. Buchanan and Dr. Jennings, two eminent practitioners of Nashville, but no stone was detected. His symptoms never returned, with any severity, after my visit, and I was informed, only a few months ago, that he is perfectly free from calculous disease. No one can doubt, for a moment, that this was a case merely of morbid sensibility of the mucous membrane of the bladder attended with neuralgic pain. The roughness alluded to was probably caused by a slight incrustation of lymph. I would not have cut this patient for the whole State in which he lives.

Ulceration of the bladder, chronic enlargement of the prostate gland, stricture of the urethra, and disease of the ureter or kidney, may all give rise to errors of diagnosis. In suppuration of the latter organ, the matter often collects in the bladder, and by its acrimony irritates the mucous membrane, much in the same manner as a stone. A calculus impacted in the lower extremity of the ureter may occasion all the symptoms of a vesical concretion; they are usually, however, attended by more pain in the lumbar region, by a greater amount of constitutional disturbance, and by less distress in voiding the urine. In some instances, the foreign body may be felt by the finger carried high up into the rectum. Chronic enlargement of the prostate gland often induces a train of symptoms very similar to those of a vesical calculus. The patient, in the advanced stage of the disease, is troubled with frequent and difficult micturition, pain, and burning in the bladder, irritation of the urethra and head of the penis, a feeling of weight in the pelvis, and a turbid, offensive state of the urine. The marks of distinction are, that the suffering is less liable to be aggravated by exercise, that the intervals of ease are longer, and that the enlarged organ can be readily felt through the rectum.

A tight, elongated, and ulcerated state of the *prepuce* may induce symptoms closely resembling those of stone in the bladder. Such an occurrence is most liable to happen in young boys, in consequence of a want of cleanliness; but it may also take place in adults. The irritation thus produced is reflected along the urethra

to the bladder, causing a frequent desire to micturate, with more or less spasm, and sometimes even a sudden interruption in the stream of urine. The sound will prevent the commission of error, and the knife will effectually eradicate the disease.

In the female, the malady is sometimes simulated by a vascular tumor of the *urethra*. The same effect may be produced by inflammation, ulceration, and granular disease of the mouth and neck of the uterus. The circumstances, which are well known to obstetricians, are sufficiently common to merit attention whenever there are symptoms of vesical irritation, obstinately resisting the ordinary modes of treatment.

Incredible as it would seem, calculus of the bladder is sometimes simulated by *aneurism* of the abdominal aorta, as in the interesting case related by Mr. Fenwick, of England.¹ The subject of the case was a man thirty-two years of age, for the last two of which he had labored under distress of mind and was otherwise indisposed. For some time past, he complained of violent pain in the head of the penis and pubic region, during and after micturition, also of pain in the kidneys and epigastrium; the urine was red, and deposited a thick sediment; the tongue was white, and the appetite bad. The symptoms appearing to indicate the presence of stone in the bladder, a sound was introduced, but no calculus could be detected. There was nothing which created a suspicion that the disease was aneurism. The patient, soon after he was admitted into the Infirmary at Newcastle-upon-Tyne, died under symptoms of great exhaustion, preceded by sudden fainting. The abdomen was found filled with blood, which had proceeded from the rupture of an aneurism of the aorta, about the size of an orange; it had produced caries of the bodies of the vertebræ on which it rested, and was accompanied by hypertrophy of the left ventricle of the heart and thickening of the tricuspid valve. There was no calculus in the bladder, and no disease in any portion of the urinary organs.

"This case," as Mr. Fenwick remarks, "presents an instance of a fact frequently observed in the practice of medicine, that an irritation applied to a nerve is often only indicated by pain in a distant part. Here the pressure upon the aortic plexus produced the usual symptoms of calculus in the bladder, by means, we may suppose, of the communications of the aortic with the hypogastric plexus of nerves."

¹ London Lancet, Jan. 24, 1846; also Amer. Journ. Med. Sciences, vol. xi. p. 492. New Series.

h. Latent Stone.—The presence of a stone in the bladder generally gives rise to well-marked symptoms, which, if they are not characteristic, always strongly point to the affected organ, and ultimately lead to the detection of the foreign body by the sound. There are, however, instances in which this morbid product may exist in the bladder for a long time, and even acquire a large bulk, without occasioning any local suffering indicative of its formation, such as spasmodic pain, frequent micturition, and sudden interruption of the stream of urine.¹ To cases of this kind the term latent may very properly be applied.

Latent stone is most common in advanced life, though it occasionally occurs at an earlier period. I am not aware that it has ever been noticed in children or young adults.

It is not easy to account for the absence of suffering in such cases. Various circumstances have been adduced for the purpose of explaining it, but very few of them are, it must be confessed, either philosophical or satisfactory. The generally received opinion is that it is owing to the smoothness and immobility of the morbid product, and to the want of sensibility of the mucous membrane. This view appears to be confirmed by the interesting cases mentioned by Frère Côme,² and Van Helmont. In the former, that of a watchmaker, forty-five years old, the patient never experienced any suffering in the bladder, except that he could not retain his water long. This continued for many years, when one day, in lifting a heavy clock, he was suddenly seized with a severe pain in the hypogastric region. This becoming gradually more and more insupportable, he was induced to enter one of the public hospitals of Paris, where the sound detected a large calculus, which was removed by the high operation, and which weighed twenty-four ounces. In the case related by Van Helmont, the patient, a priest, without any previous suffering, suddenly experienced symptoms of stone from lifting a book. The concretion was easily detected by the sound, and was afterwards removed by an operation. In each of these instances the calculus evidently changed its situation, in consequence of the exertion made

¹ Henricus ab Heer (*Observationes Medicæ variores*, ob. 26, 1685) mentions an instance in which the stone attained the magnitude of a goose's egg, without producing any symptoms. Mr. Howship (*A Practical Treatise on the Urinary Organs*, p. 125, London, 1823), states that he examined the body of a man whose bladder contained at least a dozen calculi, several of them as large as a chestnut, and yet he never had any symptoms of the disease.

² Deschamps, *Traité de la Taille*, t. i. p. 166.

by the patient in lifting a heavy weight; it might have been encysted, inclosed in a pouch, or attached by a band of false membrane, which gave way at the moment, and thus led to the usual symptoms, as well as to the necessity for an operation. When the concretion lies loose in the bladder, the absence of symptoms may be accounted for by supposing that there is great and permanent insensibility of the mucous membrane of the bladder, such as might be supposed to exist in partial or complete paralysis of that organ. A case, recorded by Deschamps,¹ appears to have been of this description. The patient, an octogenarian tailor, had frequent retention of urine from palsy of the bladder; and, although a stone was distinctly felt by the sound, he never experienced any of the ordinary phenomena of the malady.

A case, in which there appears to have been an absence of local symptoms, although the bladder contained a large number of loose, as well as encysted calculi, is mentioned in a preceding section. It occurred in an old man, a patient of Dr. Johnson, of Richmond, Virginia, and is one of the most remarkable examples of vesical calculi on record.

We are not sufficiently familiar with the latent form of vesical calculus to enable us to judge what influence affections of other parts of the body may have in disguising it, or preventing the development of local symptoms. Further and more faithfully conducted observations than any that have yet been made can alone settle this question. For the present, it is enough to know that such a form of disease occasionally exists.

i. State of the Bladder as ascertained by sounding.—One great object in sounding is to determine, if possible, the existence or non-existence of stone. Another object, hardly less important, especially in reference to the ultimate dislodgment of the foreign body by an operation, is to ascertain the condition of the urinary apparatus. This can frequently be accomplished in no other manner. By moving the instrument about the bladder in different directions, touching first one part and then another, and duly weighing the impressions which it conveys to the hand, we become apprised of the capacity of the organ, and the amount of its sensibility or tolerance. Moreover, we can generally determine, with considerable accuracy, by such a mode of exploration, whether the inner surface of the bladder is smooth or rough, ulcerated or

¹ *Op. cit.* t. i. p. 165.

fasciculated, incrustated with lymph or sabulous matter, or studded with fungous, fibrous, or other morbid growths. The passage of the sound along the urethra enables us to judge whether this tube is healthy or diseased, contracted, changed in its direction, or obstructed by the presence of a foreign body or an adventitious formation. The condition of the prostate gland is best determined by inserting the finger into the rectum, at the same time that the sound is pressed against it from before backwards. We can thus often pretty accurately measure its dimensions, its degree of consistence, and the amount of obstruction which it produces at the neck of the bladder, both as it respects the emission of the urine and the passage of our instruments. The anus and rectum should also be carefully examined, either by the finger alone, or by means of the speculum, with a view to ascertain whether they are healthy or diseased. The light which we derive from these explorations frequently enables us to form a tolerably correct idea of the propriety of surgical interference, or the probable issue of the case.

SECTION VII.

PATHOLOGICAL EFFECTS.

Although the formation of vesical calculus is the immediate result of a morbid condition of the urinary secretion, the bladder and its associate organs are generally diseased, to a greater or less extent, in the progress of the affection. The primary impression is probably always made upon the viscus in which the concretion is confined; but the irritation which its protracted presence there induces is gradually reflected upon the other portions of the apparatus, awakening in them, in the first instance, important sympathetic actions, and ultimately serious structural lesions. The secondary effects thus set up are sometimes sufficient to mask the original disease, and often lay the foundation for the patient's destruction, long before it would otherwise take place. The morbid anatomy of vesical calculus, considered in reference to its different stages, is still imperfectly understood, owing to the fact that comparatively few opportunities are afforded for investigating it. It would be interesting and important, in a practical point of view, to determine the relative frequency of the secondary effects of this disease, the period of life at which they are most liable to occur, and the degree

of influence which is exerted upon them by the age, volume, and nature of the calculus.

The bladder, accustomed as it is to the constant contact of the urine, a fluid of so heterogeneous a character, can rarely, for any length of time, bear the presence of a calculus without suffering more or less injury. One of the first, and indeed almost necessary effects, to which the foreign body gives rise, is inflammation of the mucous coat. This occurs for the most part early in the complaint, and varies in its degree in different cases and under different circumstances. The symptoms are spasmodic pains in the lower part of the pelvis, frequent desire to make water, and an increased secretion of vesical mucus. The inflammation is most severe at the neck and bas-fond of the bladder, and is generally much increased by rough exercise, and by whatever has a tendency to stimulate the contraction of the bladder, or change the position of the foreign body.

Another effect, and that not an infrequent one, is a thickening of the lining membrane, accompanied with an increased vascularity, and the development of granulations. These bodies vary in their size from that of the smallest pin-head to that of a split pea; they are of a reddish color, and frequently exist in great numbers. When they are unusually large and prominent, they give the membrane a mammillated appearance, not unlike that which is occasionally observed in the mucous coat of the stomach of phthisical subjects. They occur most frequently in the bas-fond of the organ, in old persons who have been long affected with calculus. In some instances, the inner coat is thrown into large permanent bars, folds, or ridges.

The irritation, at first limited to the mucous membrane, gradually extends to the other tunics of the bladder, especially the cellular and muscular, both of which, in turn, become hypertrophied, reddened, and indurated; these changes, which are generally most conspicuous in old subjects, in the advanced stages of the disease, are often accompanied by a fasciculated state of the bladder, or an arrangement similar to that of the inner surface of the ventricles of the heart. When all the tunics are hypertrophied, their thickness may amount to a third of an inch, half an inch, or, in very bad cases, even to an inch. Sometimes the mucous lining projects across the muscular fibres in such a manner as to form one or more pouches, in which the foreign body occasionally becomes arrested, either temporarily or permanently. A copious secretion of thick, tough

mucus usually attends these morbid changes, and, not unfrequently, even a considerable discharge of pus, lymph, or blood, or of all these substances together.

Coagulating lymph is occasionally poured out in the progress of this affection. It is usually small in quantity, and, owing to its admixture with the urine, is generally discharged along with that fluid. Sometimes, however, it becomes organized, and may thus render a stone, originally loose, more or less adherent.

A diminution in size of the bladder is not infrequent, even in young subjects, but is much more common in old persons who have labored for many years under the continued irritation of a calculus. It is almost always a concomitant of the hypertrophied and fasciculated condition, and may go on until the organ is unable to contain more than an ounce or two of urine. The opposite of this state, or an increase of size, is occasionally met with. It occurs chiefly in very old subjects, and in persons who have long suffered under paralysis of the bladder. It varies in extent from the slightest increase to double and even triple the natural volume.

Ulceration of the mucous coat is another effect of stone of the bladder. It is most frequently observed at the neck and *bas-fond* of the organ, in the advanced stages of the complaint, but it occasionally exists at an early period, and before the concretion attains much volume. In the latter case, the probability is that the disease is of a scrofulous character. The ulcers vary in extent, in number, and situation, and are productive of the most violent suffering, though the symptoms to which they give rise are not characteristic.

One of the most distressing accidents which take place, during the progress of this disease, is perforation of the bladder, followed by a partial or complete escape of the stone, and the formation of a fistule. It is denoted by severe local suffering, along with much constitutional disturbance, and occurs mostly in the advanced stages of the malady, when the patient's strength is much reduced by protracted irritation, and generally proves incurable. When it is accompanied by extravasation of urine into the surrounding cellular tissue, it may terminate fatally in a few days, or lead to violent inflammation and suppuration, inducing death at a more distant period. The part of the bladder most prone to perforation is the *bas-fond*, because, being the most dependent portion of the organ, it is more constantly in contact with the foreign body; but the opening may take place at any point. Thus, a calculus has been known to escape at the groin, above the pubes, and at the perineum.

In the female, it may be discharged through the vagina, and thus occasion a vesico-vaginal fistule.

CASE.—A very interesting case of stone of the bladder, followed by abscess and fistule of the groin, was communicated to me two years ago by my friend Dr. B. D. Hodges, of Cartersville, Mississippi. His patient, Levi Conger, was twenty-two years of age, and had formerly suffered severely from coxalgia of the left side. He had labored under vesical symptoms for about twelve months, during the last three of which he had been constantly confined to his bed. He was much emaciated, had occasional attacks of fever, and voided his urine, on an average, every two hours, his distress at such times being always most intense. He would violently compress the head of the penis with his thumb and fingers, cry most piteously, and be thrown into a state of opisthotonos. The urine could be passed only when he was in the erect position, and the effort was nearly always accompanied by a discharge of feces. The sound very promptly detected a calculus. Finally, to add to the man's suffering, an abscess formed in the left groin, midway between the pubic symphysis and the antero-superior spinous process of the ilium, large enough to admit the finger to the depth of an inch and a half. The integuments gradually gave way, followed by an abundant flow of pus, and the establishment of a fistule, allowing of the free passage of the urine. Indeed, the fluid was oozing out at this point nearly incessantly. The lateral operation being performed a short time after this, an attempt was made to extract the stone with the forceps, but it broke into numerous fragments, which were afterwards removed with the scoop, finger, and syringe. The bladder was much contracted, and seemed to have moulded itself to the shape of the concretion, which was about the volume of a turkey's egg, and partially adherent to the walls of the organ. Notwithstanding the unfavorable condition of the patient, he made a very excellent recovery; the wound, which discharged pus very freely for some days, rapidly healed, the fistule gradually closed up, the health and strength progressively increased, and in a few months the whole of the urine was voided by the natural channel.

The urethra rarely suffers, except in its prostatic portion, which may be unnaturally red, inflamed, hypertrophied, or attenuated. When the calculus is small, and is often forcibly impelled into the tube by the stream of urine, it may become greatly dilated, and even transformed into a pouch.

A calculus seldom remains long in the bladder without exciting disease in the prostate gland. This frequently happens, even in very young subjects, and while the malady is still in its incipency: but is much more common in the aged and in the more advanced periods. The organ, from the continued irritation which it suffers, receives an unnatural amount of blood, in consequence of which it gradually increases in volume and density, and thereby immensely aggravates the primary affection. It sometimes enlarges in every direction, impeding the flow of urine, augmenting the pain and spasm of the bladder, and even producing serious pressure upon the rectum. Ulceration, abscess, and sloughing may follow from the constant and excessive irritation. In some instances, the pros-

tate is converted into a cavity, nearly equal to that of the contracted bladder itself, and capable of lodging a calculus of considerable size.

The ureters are frequently reddened and thickened, and sometimes even ulcerated. One or both are occasionally enormously enlarged, or one is enlarged and the other contracted. These changes are most common in old subjects, and in protracted cases.

The kidneys rarely entirely escape in this disease. There are few cases, of long standing, in which they are not abnormally red, inflamed, increased in size, or altered in structure. In the worst forms of the malady, it is not unusual to see one of them converted into a large pouch filled with purulent matter, or turbid urine.

Abscesses and fistules occasionally form in the perineum; and, from the frequent straining to which the patient is subjected in micturition, prolapse of the anus takes place, attended with relaxation of the sphincter muscle, inflammation and thickening of the mucous membrane, and hemorrhoidal tumors.

The orifices of the seminal ducts are, in many cases, dilated, or otherwise affected, and the ducts themselves may be variously altered. The seminal vesicles are sometimes atrophied, or diminished in volume, and changed in structure. When the neck or bas-fond of the bladder suffers much, one or both of these reservoirs may become acutely inflamed, and sometimes even gangrenous.

It may be mentioned, in this connection, that a calculus of the bladder has sometimes obstructed parturition, and required extraction before the labor could be completed. Such a case recently occurred in the practice of a French physician, Dr. Monod, in a woman of forty, pregnant for the first time. The membranes had been ruptured, and the pains were frequent; but the labor did not advance by reason of a large tumor on the anterior wall of the vagina: it was hard to the touch, and completely filled the entrance of the canal. From its form and position it was readily recognized as a vesical calculus, and the diagnosis was confirmed by the sound. An incision was made into the walls of the tumor with a curved bistoury, and the stone, weighing nearly three ounces, was removed with the fingers.¹

In a similar case, related by Mr. Thrallfall,² of Liverpool, both

¹ New York Journ. of Med. and Surg. p. 274, Sept. 1850.

² London Med. and Surg. Journ. vol. ii. p. 180. 1829.

mother and child were permitted to perish, in consequence of the nature of the obstruction not being detected until after death. The woman was thirty-four years of age, and had suffered much from ill health for a long time. The tumor, which was supposed to be ovarian, occupied the lower part of the right side of the pelvis, and, although it was slightly movable, all attempts to push it above the superior strait proved completely futile. The head of the child was finally opened, but too late to do any good, and the woman died exhausted from fruitless labor pains. On examining the parts, it was found that the supposed tumor was a stone within the bladder, weighing upwards of six ounces and a half, and measuring three inches and five-eighths in length, by two inches and seven-eighths in breadth, and two inches and a fourth in thickness.

Finally, another effect which occasionally occurs is the *spontaneous fracture* of the calculus, succeeded by violent irritation of the bladder, and sometimes even the death of the patient. The organ, unaccustomed to the presence of more than one such body, resents the encroachment of the fragments, which are occasionally very numerous, in the same manner it does the invasion of a foreign body, accidentally introduced from without. The sharp, angular, and rugged points of the fragments fret and irritate the mucous membrane, which is thus induced to take on inflammation, which is sometimes so intense and so unmanageable as to destroy life in a few days. Besides, some of the pieces may lodge in the urethra, and produce partial or complete retention of urine.

The immediate cause of fracture of urinary calculi within the bladder is no doubt the inordinate contraction of the muscular fibres of this organ. It may also be produced, I should think, by the stones, especially if they be numerous, striking violently against each other during severe bodily exercise, as in leaping and running. The accident, which has been observed both in man and in the inferior animals, will be more likely to happen when the bladder is considerably hypertrophied, and the concretion comparatively soft or fragile. In one remarkable instance, a calculus was broken into forty fragments.

The dangers of this accident are strikingly illustrated by the circumstances of a case which happened in the practice of the late Mr. Liston.¹ A physician, who had labored under symptoms of stone for a long time, and who had ascertained the existence of the foreign

¹ Elements of Surgery, p. 583. Phila. 1846.

body by sounding himself ten years previously, met Mr. Liston one morning in consultation. Three days after, he was called to the gentleman, whom he found nearly moribund from inflammation of the whole urinary apparatus, his urethra being at the same time blocked up by large fragments of stone. It appeared that on parting with him, immediately after their consultation, he had been suddenly summoned to an urgent case of midwifery. He ran quickly down a steep street, at the bottom of which he was seized with an irresistible desire to make water, which he did in small quantity, mixed with much blood. He passed some pieces of stone with very sharp angles. His symptoms grew worse; he had retention from obstruction of the urethra; suppression followed, and death terminated his sufferings in a very few days. Many portions of the calculus were voided, and many others, with the nucleus, occupied the bladder and urinary passage. The kidneys were dark-colored, and one appeared to be nearly gangrenous. The practice in this case, as soon as its nature was fully ascertained, should have been, as Mr. Liston justly observes, to cut into the bladder, and clear it of its contents.

SECTION VIII.

TREATMENT OF STONE.

The treatment of stone in the bladder necessarily divides itself into medical, chemical, and surgical, of which the former is, in general, merely palliative, though frequently of paramount importance, whether it be considered only with reference to the temporary comfort of the sufferer, or as a means of improving his health with a view to his relief by an operation. Each of these subjects should be well understood, and it will therefore be proper to discuss them somewhat at length.

ART. I.—MEDICAL TREATMENT.

Persons affected with stone in the bladder do not always find it convenient to submit to the operation of lithotomy, and it therefore becomes a matter of great importance to render them as comfortable as their circumstances may admit of. By attention to the general health, as regulated by food, drink, and exercise, much may be done to allay local suffering, and make the patient almost forget his disease. A concretion, which may have been a source of great

distress for years, may, by appropriate and well-directed treatment, become a comparatively harmless tenant of the bladder, and thus convert a state of torture into one of elysium. Many cases are on record, in which, from the improvement of their symptoms, calculous subjects have imagined themselves cured of their ailments, when, in fact, the change they experienced was solely owing to the increased tolerance of the organ, in consequence of the effects of remedies. The improvement thus produced has sometimes lasted many years, though, in general, it is comparatively short. A consideration of this circumstance has led to a belief, not altogether unfounded, that urinary concretions are sometimes dissolved in the bladder, and voided along with the urine. Hence, certain remedies, supposed to be endowed with this property, have received the name of *lithontriptics*, or solvents and disintegrators of stone.

Much of what might be said under this head has been anticipated in the article on the different calculous deposits. A brief statement of the more prominent facts must, therefore, suffice in this place.

It is hardly necessary to remark that a due regulation of the diet is of paramount importance in the treatment of stone in the bladder. Most patients, in fact, know from painful experience, the kind of food and drink that agrees best with the stomach. In adults, therefore, little caution in this respect is necessary; but in children, who are unable to judge for themselves, the proper injunctions should always be given to the parents and nurses. Without entering into minutiae, which the limits of this treatise forbid, it may be observed, in general terms, that the diet should be plain and simple, easy of digestion, and yet sufficiently nutritious. Plainly roasted meats, boiled fish, mealy Irish and dry sweet potatoes, well-boiled rice and hominy, soda biscuit, and stale wheat bread, with weak tea, or milk and water, are, in general, the most suitable articles. Coffee, wine, and fermented liquors, cider, and subacid fruits, with pastry, and the coarser kinds of vegetables, are to be eschewed. If the patient be feeble, or has been in the habit of using liquor, a little French brandy, or, what is better, Holland gin, may be allowed at dinner, and after exercise. Gin, as is well known, has a sort of specific tendency to the urinary organs, and its exhibition is occasionally attended with good effects. Some persons are greatly benefited by hop-tea, beer, or malt liquors. Generally speaking, however, these articles produce more harm than good. All kinds of water impregnated with lime must be abstained from, from their tendency to favor the increase of calculous deposits. The patient should be

well clad, avoid exposure to wet and cold, and refrain from rough exercise of every description. In the winter, he should keep himself well housed, or reside, if possible, in a warm and genial climate. Sexual excitement must be carefully guarded against, for any indulgence of the kind is always sure to be followed by an aggravation of the complaint.

The urine must, in all cases, be kept in as neutral a condition as possible. If it be acid, alkalines are indicated, and contrariwise, if it be alkaline, acids are required. Frequent examinations of this fluid are, therefore, necessary, in order that the remedies may be varied as the circumstances of each particular case may render it proper. These examinations may commonly be made by the patient himself, or by his nurse, who should always be instructed by the attendant in the use of the usual tests. It should be remarked here that some patients are most benefited by alkalies, others by acids, even when the urine and the stone are both apparently of the same character. No satisfactory reason can be offered for this seeming discrepancy, with which every physician of experience is familiar. In my own practice, I have generally derived most benefit from the use of alkaline remedies, whatever may have been the nature of the diathesis or concretion.

The best alkalies in the treatment of vesical calculi are, beyond all question, the bicarbonates of soda and potassa, either alone, or variously combined with each other. In my own practice, I have generally given a preference to the soda, for the reason that it has seemed to me to exert a more obtunding effect upon the mucous surfaces of the urinary passages. The best form of exhibition is in solution in strong hop and uva ursi tea, in the proportion of thirty grains to the ounce, three or four times a day. Some practitioners are in the habit of administering it in large quantities of rain water. Whatever vehicle be adopted, the best period for using the medicine is about one hour after meals, and at bedtime, just before the patient retires. Exhibited in this way, it readily mixes with the ingesta, prevents the evolution of acidity and flatulence, and exerts a more controlling influence over the urinary secretion. The quantity of the salt may be gradually increased to forty, fifty, and even sixty grains, according to the tolerance of the stomach; and a good plan is to premit the use of it occasionally for a few days. Carbonate of potassa is sometimes employed alone, but its beneficial influence is always greatly enhanced by giving it in union with soda. The liquor potassæ, as it is called, sometimes answers an

excellent purpose in these cases, particularly in persons of a dyspeptic habit. It should be administered largely diluted with water, in doses varying from twenty to forty drops, three times daily, or, what is better under such circumstances, in combination with some of the simple bitters, as tincture of gentian, quassia, or cinchona. Some patients derive much benefit from the free use of lime-water, Castile soap, magnesia, and lye. The celebrated remedy of Mrs. Stephens, purchased more than a century ago, at an enormous expense, by the English government, consisted of Castile soap and egg-shells. During the height of its renown, and before its composition was disclosed, it was the fashionable medicine with calculous patients, of every condition and rank in Great Britain; it was swallowed in large quantities, and there is reason to believe that it often produced the most salutary effects. It not only generally allayed the vesical symptoms, but occasionally dissolved the stone, as is proved by a number of well-authenticated cases. In one case, lime-water was substituted for egg-shells, and the results were equally remarkable and striking. As illustrative of the influence of this remedy, and the extraordinary quantity in which it was sometimes taken, is, among many others, the remarkable instance of David Miller, as related by Dr. Whytt, of Edinburgh.¹ This man had long been a victim to stone of the bladder; his sufferings were of the most excruciating character, and he had tried, but in vain, a great variety of means for his relief. He finally had recourse to Castile soap to the extent of an ounce and a half daily, washed down with three pints of lime-water, and soon experienced decided benefit; his condition gradually improved, and at length, after passing, at different times, several fragments of calculus, he was completely freed from his misery. He remained well for eleven years, and when he died no stone was discovered.

Marked benefit, sometimes of a permanent character, springs from the long-continued use of certain *mineral waters*. Many cases are related in which local suffering disappeared, and particles of stone were voided, under their influence. Their efficacy, in the treatment of this disease, doubtless, depends upon the property which they possess of depriving the urine of its acids, and thereby neutralizing it, or rendering it alkaline. Their virtues, in this respect, have been known from remote antiquity, and have been

¹ Essay on the Virtues of Lime-water and Soap in the Cure of Stone. Edinburgh, 1752. Willis on Urinary Diseases, p. 184. Phila. 1839.

fully attested by modern experience. Of the various waters celebrated for their virtues of solving calculi and soothing the bladder, those of Vichy, in France, are the most remarkable, on account of the numerous cases that have been relieved by their use. Their reputation extends back several centuries, and their efficacy has been corroborated by the testimony of some of the most respectable physicians of modern times. Space will not permit me to enter into any particulars on this subject, but those who wish to enlarge their knowledge respecting it will find ample references in the admirable treatise of Dr. Willis on *Urinary Diseases*, and in an able and interesting article on stone in the bladder, in the twelfth volume of the *British and Foreign Medical Review*. The Vichy waters contain a large quantity of free carbonic acid, and very nearly a drachm and a half of bicarbonate of soda in every thousand drachms of the menstruum, upon the presence of which their good effects no doubt depend. The probability is that these and similar waters act not as mere diluents, but that they also exert some chemical influence upon the urine. Whether any of the mineral waters found in such immense numbers and varieties in this country, possess virtues similar to those of the Vichy waters as stone solvents, experience has not determined. It is certain, however, that many calculous patients have derived much benefit from their use.

When the urine is decidedly alkaline in its character, *acids* are indicated, and it is remarkable how soon, in many cases, under these circumstances, their good effects become manifest. How these fluids act in producing their beneficial results, is still a mooted point. It has been supposed by some that they enter the circulation and exert a direct impression upon the blood, thereby counteracting its tendency to the formation of alkalies. Others, on the contrary, believe that their beneficial effects take place in the kidney, by the chemical change which they produce in the secretion of this organ. The probability is that both explanations are correct. Be this as it may, it is certain that most persons affected in this manner derive signal advantage from the use of these remedies, for they seldom fail to improve the condition of the digestive apparatus, to allay flatulence, and to promote the appetite, and, just in proportion as they do this, do they improve the state of the urinary organs. The length of time during which they should be continued must depend upon circumstances. I have found in my own practice that the alternate use of acids and alkalies is generally productive of more

benefit in the treatment of calculous complaints than the protracted use of either of these substances alone.

The acids which are usually employed to produce these changes are the nitric and muriatic, of which the former is the preferable. The best form of exhibition is the dilute nitric acid of the shops, in doses of from twenty to thirty drops, three times daily, in nearly half a tumblerful of cold water, sweetened with a little sugar, to render it palatable. The sulphuric acid is also sometimes used, but its good effects are less apparent, and occasionally it seems to be rather prejudicial than beneficial. Much improvement sometimes results from the exhibition of phosphoric acid; and cases occur in which marked relief follows from the use of certain vegetable acids, as the citric and tartaric.

A few years ago, Dr. S. W. Butler, of Burlington, New Jersey, called the attention of the profession to the lithontriptic properties of the *hydrangea arborescens*, citing several cases of its beneficial effects from the practice of his father, Dr. E. Butler, an old and experienced practitioner among the Cherokee Indians. Living in a region of country where calculous affections are not infrequent, this gentleman had numerous opportunities of testing the virtues of this article, and his conclusion was that it is a remedy of superior efficacy, worthy of further and more extended trial. It appears, according to his testimony, to be particularly efficacious in promoting the discharge of sand and gravel from the kidneys and bladder, and in relieving the excruciating pain attendant upon the passage of calculi through the ureters. He has been in the habit of employing the *hydrangea* in the form of a syrup, prepared with two pounds of the fresh root to a gallon and a half of water, boiled down to one third; two pints of honey are then added, when the whole is reduced down to one quart. Of this, the dose is a teaspoonful thrice a day. Given in larger quantities, it is liable to produce unpleasant symptoms, such as dizziness, nausea, and oppression of the chest. The manner in which the medicine acts is not understood.

Within the last few years, I have, at the suggestion of Dr. S. B. Butler, tried the *hydrangea* in a number of cases of calculous affections, as well as of irritability of the bladder, at different periods of life, and under different circumstances, as to the amount of general and local disorder; but in no instance have the high expectations which I had been led to form of its efficacy been realized. On the contrary, I have found it in every respect inferior to *uva ursi* and

hops, whether exhibited alone, or in combination with soda and potash. The form in which I have usually employed it has been that of a strong decoction, which may, perhaps, be inferior to the syrup recommended by Dr. Butler. Very recently, Dr. Washington L. Atlee, of Philadelphia, has published a number of cases of calculous and other diseases of the bladder, in which he made trial of the hydrangea, sometimes as a curative agent, and sometimes as a prophylactic, without, so far as I can judge, any marked benefit, except in a very few instances. Still, notwithstanding this, the article, as was said before, is, I think, deserving of further and more extended trial than it has hitherto received. Combined with uva ursi and soda, its efficacy would probably be greatly increased, for it is well known that certain remedies produce a much happier effect when judiciously united with others than when they are given by themselves.

It will not be improper, in connection with this remedy, to mention another, which, from the high encomiums lavished upon it fifty years ago, in the treatment of this class of disorders, deserves, I think, to be reintroduced to the notice of the profession. I refer to the *peach-leaf*, the anti-nephritic qualities of which were first described by Sir William Bishop,¹ surgeon at Maidstone, in Kent. In the case in which he first tried it, the most prompt relief was obtained after a great variety of other means had failed. The remedy was administered in the form of decoction, prepared by boiling an ounce of the dried leaves in a quart of water, till it was reduced to a pint and a half. Of the strained liquor, the patient, a woman, aged forty-two, took a pint daily, and at the end of thirty-six hours after she commenced its use her calculous symptoms began to improve; the urine, which had previously been bloody, rapidly resumed its natural color, and in a short time she was entirely restored. Dr. R. White,² of Suffolk, England, also speaks in terms of high commendation of the anti-nephritic properties of this article, asserting that he has known it to exert the most prompt and powerful influence over the expulsion of calculous matter from the bladder and kidneys. The probability is that its beneficial effects are due, at least in some degree, to the presence of hydrocyanic acid. It is not unlikely that a valuable syrup of the leaves and kernels of the peach might be prepared for internal exhibition in this class of diseases.

¹ Medical Facts and Observations, p. 122. London, 1800.

² London Medical Review and Magazine, p. 81. 1800.

ART. II.—SOLUTION OF CALCULI.

The idea of dissolving stone in the bladder by means of injections is not new. The celebrated Dr. Hales, of England, busied himself with this subject early in the last century, by experiments, both upon man and dogs, and he even invented a double-current catheter, which he used for washing out this sac, and directing his fluids with greater certainty against the foreign body. About the same time, a French surgeon, of the name of P. Desault, published an account of dissolving stone, in which he recommended the use of the Barèges water, not only by the mouth, but by way of injections into the bladder. In 1752, Dr. William Butler, of Edinburgh, instituted experiments with lime-water, and a case soon after occurred in the practice of Dr. Rutherford, of that city, in which this mode of treatment was followed by complete success. Subsequently, the same plan was recommended by Fourcroy, Berzelius, and other chemists, through whose influence the subject has been prominently brought before the profession of the present day. Magendie, Amussat, Leroy, Brodie, and Willis, have done much to attract attention to it in France and England, and to establish its claims upon the confidence of the practitioner.

The injections employed for dissolving stone in the bladder have varied in the hands of different surgeons. Some, as Dr. Jurine, of Geneva, and J. Cloquet of Paris, use simple water; others prefer lime-water. P. Desault, as has been already seen, recommended injections of the Barèges water; Petit, Chevallier, and D'Arcet, on the contrary, speak favorably of injections of the Vichy water. Dr. Ritter, of Cassel, succeeded in removing a stone from the bladder of a gentleman of forty, by injections of weak solutions of the caustic alkalies, assisted by the same medicines taken by the mouth.¹ Dr. Dorsey, of Philadelphia, made numerous experiments on the solution of calculi with the gastric juice of the inferior animals: the same fluid was previously recommended by a pupil of Spallanzani, and favorable mention has been made of it, within the last few years, by Millot, a French surgeon, who proposes to use it, diluted with equal parts of tepid water. Pelouze and Gay-Lussac recommended borate of soda, which they think possesses more energetic solvent powers than the bicarbonates of soda and potassa. In Eng-

¹ Brit. and Foreign Med. Rev. vol. xii. p. 399.

land, trials have been made with malic acid and nitro-saccharate of lead, but with no satisfactory results. Mr. Brodie has, in several instances, successfully employed injections of nitric acid, in the proportion of about two drops to the ounce of water. Muriatic acid has also been used.

Whatever substance be used, care must be taken not to inject too much at first, and also that the solution is not so strong as to irritate the mucous surfaces. As the bladder becomes accustomed to the medicine, it may be employed more freely, and of greater strength. One daily injection is generally sufficient; some patients, however, bear two and even three. The bladder should always be emptied just before its administration, and the fluid should be retained as long as it can be conveniently borne. When much mucus is present, the bladder should be previously washed out with tepid water, thrown up through a double catheter. The treatment generally requires to be continued for several months before any decided impression is made upon the concretion, and should always be aided by the free internal use of lithontriptic remedies.

The kinds of calculi which are most amenable to medicated injections are the phosphatic, which are comparatively soft and friable, and are therefore easily disintegrated, or so reduced in size that they may readily escape through the urethra. The best solvent for them would seem to be nitric acid, of the strength of two drops to the ounce of water, as employed by Mr. Brodie, passed in a slow and steady current over the concretion by means of a double catheter. Solutions of alkalies, borax, and other alkaline salts have been used in cases of lithic calculi, in combination with their internal administration, and have often afforded great relief; either effecting their disintegration, or so modifying the action of the bladder as to render them comparatively harmless. No attempts that have yet been made to solve mulberry calculi have succeeded. Modern chemistry may possibly discover some remedy which may have this effect.

I have no experience with this mode of treating stone, and I suppose few surgeons in this country have. Most of our calculous patients are from a distance, and are anxious, when they reach us, to be relieved as speedily as possible of their burden. Few have the time, or means, or patience, to submit to a process, which, while it must always be tedious and inconvenient, is generally uncertain, sometimes painful, and not always devoid of danger. The subject, however, is worthy of further attention, and it is to be hoped that it will be investigated in a manner commensurate with its importance.

Galvanic electricity has been applied to the solution of urinary calculi. This agent was first suggested, for purposes of this kind, by a French physician, of the name of Bouvier Desmortiers, who actually performed some experiments with it, though the effects which he obtained were very tardy and unsatisfactory. The subject was afterwards taken up by Gruithuisen, Prevost and Dumas, Bonnet, Willis, and other practitioners, with hardly any better success. One great obstacle to the employment of this remedy, is the difficulty of transmitting the galvanic fluid to the concretion, the disintegration of which it is intended to effect. Gruithuisen, who was fully sensible of this difficulty, proposed to remedy it by the construction of a canula, capable of containing two isolated wires, the ends of which were placed in immediate contact with the foreign body. By this arrangement, set in play by a battery of three hundred pairs of plates, he supposed it possible to destroy almost any stone, however large or firm. He has left, however, no evidence that he succeeded in accomplishing his object. Indeed, it would be hard to find a single well-authenticated case of disintegration of a calculus by the application of this agent. Modern science has supplied us with much better means for transmitting this fluid into the affected organ, but it is a question, whether, with all the knowledge we possess, the treatment is really worthy of serious consideration. My own opinion is that little is to be expected from it, and that it would be a mere waste of time to resort to it. There are few calculous patients that would not rather be cut than galvanized.

ART. III.—EXTRACTION OF CALCULI THROUGH THE URETHRA.

The fact that small calculi sometimes escape during micturition was long ago noticed by practitioners, and has been turned to good account by modern surgeons. When it is known, for example, that a concretion has recently descended from the kidney, its expulsion from the bladder may occasionally be effected by making the patient grasp the head of his penis, while he distends the urethra with urine; then, letting go his hold, he empties his bladder with all the force he can direct upon it by the action of the diaphragm and abdominal muscles. The water should be previously accumulated to the greatest possible extent, and during its evacuation the patient should lie upon his belly, or bend his body forward, to place the stone in the most favorable position for reaching the urethra. These attempts at extrusion are generally

much facilitated by the prior dilatation of the tube by means of the bougie or catheter.¹ The canal, being thus expanded to a greater or less extent, will more readily admit the passage of the foreign body by the pressure of the advancing stream of water. When the concretion is quite small, a single introduction of the instrument will sometimes suffice; but, in general, systematic dilatation will be necessary, and this, it need hardly be added, should always be conducted with the greatest care and gentleness. I subjoin the following case in illustration of this mode of treatment.

A gentleman, Mr. William Pippin, sixty-seven years of age, of Livingston County, Kentucky, was brought to me in the summer of 1850, by my friend Dr. Bass, his family physician. The sound readily detected a calculus, which was so small that I proposed to crush it with Jacobson's instrument. Accordingly, the next morning, I introduced a large silver catheter, to dilate the urethra. The instrument was retained thirty minutes, when it was withdrawn, but was reinserted in a few hours to let off the urine, which refused to pass voluntarily. Soon after the water began to flow, the stone entered the urethra, and presently appeared at the external meatus, where it became impacted. Dr. Bass tried to remove it with a pair of forceps, but he succeeded in getting away only a small fragment. I saw the patient at 4 o'clock in the afternoon, and found the concretion slightly protruded at the external orifice, where it was forcibly held by the margins of the meatus, which were quite tight, and indisposed to recede. Seizing it with the thumb and fingers, I extracted it, though not without some difficulty, pain, and hemorrhage. In less than twenty minutes, the patient had a severe rigor, for which he took at once half a grain of morphia. A copious perspiration soon followed; he slept well all night, and in the morning he felt so comfortable that he was induced to return home. The concretion was upwards of three-quarters of an inch in length, and one inch and nearly a quarter in circumference at its widest

¹ A French writer, M. Aberle, states that he has frequently witnessed the expulsion of small calculi in infants, from the use of belladonna. He employs it both internally and in the form of frictions on the perineum, his object being to induce temporary paralysis in the muscular fibres of the neck of the bladder. During the relaxation which is thus produced, the stone, meeting no longer with any opposition, readily escapes by the urethra. M. Aberle relates several cases in which concretions of the size of a pea, were, under the influence of this treatment, expelled in a few hours. The paralysis always quickly subsides soon after the discontinuance of the medicine. *Encyclographie Médicale*, Fév. 1845. Little confidence, I should think, ought to be placed in such a mode of treatment.

part; it was rough on the surface, rounded at the ends, and arched at its middle. It was slightly conical in its shape, and presented by its smaller extremity. Its curved condition must have considerably impeded its passage. Mr. Pippin had voided several calculi previously, but none of them were as large as the one which I removed.

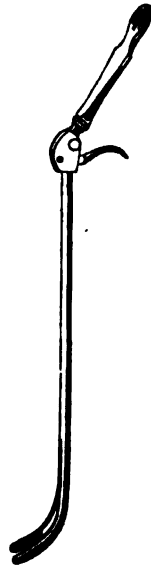
The ancient Egyptian practitioners, who were well acquainted with this operation, occasionally extracted by it calculi as large as an olive, or even a small nut. They were in the habit of effecting the dilatation of the urethra by the insufflation of air, and the introduction of extensible cartilaginous tubes. When the process was carried sufficiently far to admit of the passage of the foreign body, the latter was pushed forward into the prostatic portion of the canal by means of the finger introduced into the rectum. A wooden canula being now inserted into the urethra, in contact with the stone, the mouth was applied to its projecting extremity, when, strong suction being made, the instrument was slowly withdrawn, the concretion following it as a plug. This ingenious procedure of the Egyptians, as has been justly observed by an eminent writer,¹ in the *British and Foreign Medical Review*, is as applicable now as it was in ancient times, and might occasionally be employed with advantage in the hands of a skilful operator. An exhausting syringe should be used instead of the mouth.

Attempts have been made, especially in recent times, to remove calculi entire from the bladder, through the urethra, by means of forceps. It was observed, long ago, that during catheterism, small concretions became occasionally impacted in the eyelets of the instrument, which they followed upon its withdrawal. A circumstance, so interesting and important, was well calculated to arrest the attention of surgeons, and we accordingly find that they have taken full advantage of it. It was in this way that the late Mr. George Bell, of Edinburgh, had the good fortune to rid a patient of one hundred and fifty concretions. In performing such an operation, a full-sized catheter with two large eyes should be selected, and the bladder should be previously distended with water, so that, as the fluid runs off, the calculi may have a better chance of being forced into the tube.

¹ The article here alluded to is from the pen of Dr. Willis, of London, a gentleman who is justly distinguished for his valuable contributions to the pathology and treatment of urinary diseases.

Instruments have been constructed for the special purpose of seizing the stone, and removing it entire. Sanctorius, if not the first, was one of the earliest surgeons who busied themselves in this manner. He has described the operation with some minuteness, and has figured a pair of forceps which he contrived for performing it. Hales, Hunter, and others also invented instruments, which have been greatly improved in modern times by Sir Astley Cooper, and some of the French lithotomists. The forceps of the English surgeon, which are here represented (Fig. 104), and with which he extracted upwards of eighty small calculi from one individual, consist of two movable blades, shaped, when closed, like a curved catheter. They are introduced in the ordinary manner, and are used, at first, as a searcher. When the stone is found, the blades are gently separated and expanded over it, when, being again shut, the instrument is carefully withdrawn. An index upon the surface of the instrument serves to show the size of the calculus, or, what is the same thing, the possibility of removing it entire. When the concretion cannot be extracted in this manner, it may, if not too hard or large, be crushed, and be disposed of piecemeal.

Fig. 104.



In performing this operation, it is important that the bladder should be perfectly free from irritation, that the urethra be previously dilated by the catheter or bougie, and that the forceps do not pinch the mucous membrane. If these precautions are neglected, serious mischief may follow. At least one instance is on record where death ensued, although the operation was performed by a competent surgeon, and the forceps were introduced only twice.¹

A small calculus has sometimes been entrapped and removed by a very simple procedure. Many years ago, an American physician, Dr. Calvin Conant,² relieved a lad, aged fifteen, by means of a silver wire, passed through a catheter, the vesical extremity of which was pierced by two holes, about a line and a half apart. The wire, which was very fine, elastic, and twenty inches long, was formed, upon its arrival in the bladder, into a loop, which was then moved about

¹ Brit. and Foreign Med. Review, vol. xii. p. 404.

² Medical Repository, N. Series, vol. iv. p. 184. New York, 1818.

until the concretion was found and ensnared; the ends were next secured to the shoulders of the catheter, when both the instrument and stone were withdrawn. Dr. Conant states that the calculus was of considerable size, and that he was repeatedly obliged to relinquish his hold upon it before he was able to seize it by its long axis, or place it in a favorable situation for extraction. "Having drawn the ends of the wire very tight to keep the stone firmly inclosed in the loop, I proceeded, with gentle but varied motion, to draw it through the urethra, which I was happy enough to effect, with but little difficulty or pain to the subject." The procedure here described does not, it will be perceived, differ, in its essential features, from the operation of seizing and extracting nasal polypes by means of the silver wire and double canula. When we consider its simplicity and its adaptability to the removal of small calculi, it is surprising that it has not been more frequently employed. The process might be greatly aided, in suitable cases, by previous dilatation of the urethra.

ART. IV.—LITHOTRIPSY, LITHOTRITY, OR CRUSHING.

It is not my intention, in this place, to enter into the history of lithotripsy, or an account of the different steps by which, from humble and unsatisfactory beginnings, it has attained its present extraordinary degree of perfection. To such of my readers as are desirous of being enlightened upon the subject, the recent work of Dr. Civiale, of Paris, entitled *Traité Pratique et Historique de la Lithotritie*, published in 1847, will afford ample information, derived as it is from his large personal experience and his abundant reading. The most that I shall aim to do is to point out the manner of performing the operation, the class of cases to which it is particularly applicable, and the consequences to which, even in the hands of the most skilful, it is liable to give rise.

To Civiale mankind are, beyond doubt, indebted for the invention of an operation which threatened at one time to supersede lithotomy, and struck terror into the minds of the knivesmen. Although it is certain that he obtained some hints respecting it from previous and contemporary authors, yet it must be evident enough to every impartial inquirer that the invention was the result mainly of his own labors and ingenuity. The attempts that have been made by envious and designing men to defraud him of his claims by ransacking the writings of the ancient physicians, and ascribing to them a discovery

which justly belongs to modern times, are as absurd as they are malicious and disreputable. They remind one forcibly of the days of Paré, when that illustrious man, reviled and persecuted by his contemporaries, was compelled, by the force of circumstances, to renounce his claims to the discovery of the ligature, and to discard an honor to which he alone was entitled. But mankind are seldom long, at least in modern times, in detecting and rewarding merit; Civiale has already outlived the persecutions of his enemies, and he now enjoys the enviable reputation of being the first lithotriptist in the world.

The first successful operation of this kind was performed by Civiale in 1824, at two sittings, as they are technically named; the stone was small, and every vestige was removed. Previously to this, namely, in 1813, Gruithuisen, a Bavarian physician, proposed to seize, and perforate the stone by drilling; and in 1819, Elderton, an English surgeon, formally recommended, for the same purpose, a curved lithotrite. A few years later, Dr. James Arnott, of London, suggested the idea of using a small circular saw, introduced through a canula, for rasping calculous concretions; merely with a view, however, of obtaining specimens for chemical examination. Amussat and Leroy also busied themselves about this period in studying the subject, and rendered valuable service by the invention of several instruments. None of these gentlemen, however, made any practical application of their operations to the living subject; a circumstance which is so much the more surprising when we recollect the memorable case of General Martin. This officer, more famous for his surgical than his military exploits, in 1775, while a resident in India, invented an instrument, provided with a sort of rasp, which he passed through his urethra into the bladder, and with which he detached, from time to time, small fragments of his calculus. It was commonly believed, from the relief which he received from his operations, that he had succeeded in effecting a complete cure. When he died, however, the bladder was found to contain a large portion of stone; and the probability, therefore, is that the relief which he experienced was simply owing to the reduced volume of the concretion, to its greater smoothness, or to the manner in which it lay behind the prostate gland, in the bas-fond of the urinary sac. A full history of this remarkable case is to be found in the second volume of Sir Everard Home's work on the Diseases of the Prostate Gland.

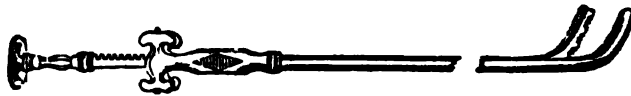
The operation originally executed by Civiale has been denominated lithotripsy, as it consisted in seizing, boring, perforating, or piercing

the calculus. The name is still retained by this distinguished writer, and likewise by some of the English, as Brodie, and Ferguson, although the operation itself has been essentially modified. As performed, at the present day, at least by most surgeons, it consists in breaking, crushing, or grinding the foreign body, and is, therefore, more appropriately termed lithotripsy.

a. Instruments.—The instrument employed by Civiale, in his earlier operations, was a silver canula, about eleven inches in length by two and a half to four lines in diameter, and containing a steel tube, furnished with three branches, claws or pincers, so arranged as to be separated at pleasure, and therefore well calculated to seize and hold the foreign body. The upper extremity of the tube was marked by a scale, to enable the surgeon to judge of the degree of expansion of the claws, after the instrument had reached the urinary sac. Within the steel tube, again, and about six inches longer than it, was a cylindrical rod, called the perforator, one end of which was fashioned into a sort of crown with sharp teeth, to bore the stone, and break it into fragments; while the other, upon which there was a graduated scale for measuring the size of the calculus, was rounded off, slightly serrated, and adapted to the jaws of a grooved pulley. Finally, the apparatus was completed by a steel drill-bow, twenty-five inches in length, jointed in the centre, but firm and elastic, and intended to move the perforator during the operation.

Although great improvements have been effected in this instrument within the last quarter of a century, there are comparatively few surgeons who do not now altogether prefer the operation of lithotripsy, not only because it is equally efficient, but because it is much more simple, and also more easy of execution. The merit of the discovery of this operation is usually, at least in this country, ascribed to Baron Heurteloup, of Paris; but there is no doubt that much credit is also due to Mr. Weiss, the celebrated London cutler. As early as 1824, this gentleman contrived an instrument for this purpose; which, after having been variously modified by different

Fig. 105.



lithotriptists, among others by Heurteloup himself, was subsequently remodelled and greatly improved by the inventor. The instrument,

as now constructed, is remarkable for its simplicity, its strength, and its adaptation to the end proposed. It is composed of two blades (Fig. 105), curved at the extremity at an angle of about 55 degrees, twelve inches in length, and about the size of an ordinary catheter; the one sliding within the other, and propelled by means of a screw. Near the upper end of the male rod is a graduated scale, intended to indicate the size of the stone. The extremities of the beak, on their inside, are serrated, or notched, the better to seize, retain, and crush the concretion. The curved portion of the fixed blade is hollow, to prevent impaction of the fragments. Fig. 106 represents the screw, or handle, by turning which in the manner indicated on the accompanying drawing (Fig. 107), the male blade is propelled onwards, slowly

Fig. 106.

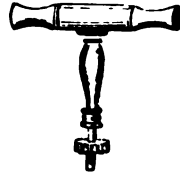
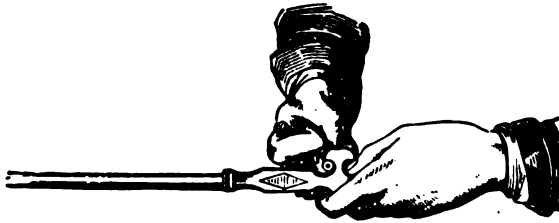
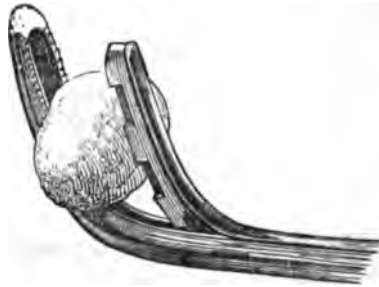


Fig. 107.



and gently, or, as observed by Mr. Fergusson, by short, sudden jerks, so as to imitate slight percussions, until the concretion is shattered. Fig. 108 exhibits the calculus in the jaws of the instrument, and Fig. 109 the instrument in the bladder, the stone being grasped in a suitable position for crushing.

Fig. 108.



Every operator should be provided with a number of these instruments, of different forms and sizes, that he may be able, without difficulty, to adapt them to the varying circumstances of his patients. When the concretion is small, or uncommonly soft, the lithotrite, sketched at Fig. 110, will generally be found to answer every purpose, as it is of simple construction, very light,

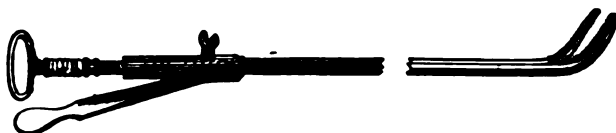
and of easy management. For the removal of little fragments, or diminutive calculi, an instrument with a short, broad, and rather abrupt

Fig. 109.



curve, the female blade of which is moulded into a kind of cup, to receive and retain the detritus, may be advantageously used. In the ordinary lithotrite, the female blade has a large fissure, to allow

Fig. 110.



the fragments, in the act of crushing, to fall away into the bladder, and thus enable the operator to withdraw the instrument without the risk of lacerating the lining membrane of the urethra. These features are well seen in the accompanying cuts (Fig. 111 and Fig. 112).

Fig. 111.



Fig. 112.



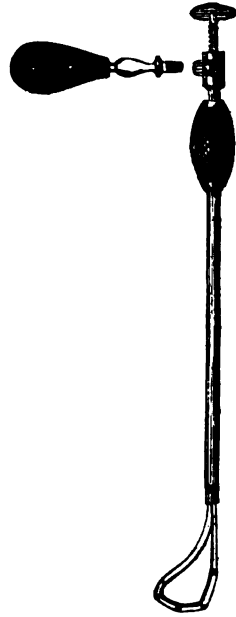
Another instrument, the merits of which are certainly equal, if not superior, to those of the one just described, is that of Dr. Jacobson, an eminent surgeon of Copenhagen. For simplicity and facility of use, it would be difficult to conceive of anything more perfect or convenient. It consists of a silver canula, about ten

inches long by three lines in diameter, the upper extremity of which is furnished with a circular steel rim, an inch in width, while the lower is slightly curved for about two inches, and terminates in a blunt point. Within this tube is a steel rod, calculated to move backwards and forwards at pleasure, and connected inferiorly, with the one just described, by means of an articulated chain consisting of three links. The superior extremity projects beyond the horizontal rim of the canula, and is furnished with a stout screw, which is intended to work the chain backwards and forwards, during the seizure and comminution of the stone. A graduated scale exists upon the instrument for measuring the volume of the stone.

It has been alleged that the lithotriptor of Jacobson is inferior, in several respects, to that of Heurteloup and Weiss; but, mainly, on account of its greater liability to pinch the coats of the bladder, and its inability to grasp so large a calculus. It is also said to be more difficult to seize the concretion so readily when it lies behind the prostate in a cul-de-sac of the bladder. These objections, however, are rather imaginary than real. In the first place, it is not an easy matter for a skilful surgeon, in any case, to include the coats of the bladder in the jaws of his instrument; the contingency, at all events, is a remote one, and can scarcely happen if care be taken to round off the margins of this part of the instrument; secondly, no calculus larger than what can be embraced by Jacobson's lithotriptor should ever be attempted to be crushed by this operation; and, lastly, if the stone lies low in the bas-fond of the bladder, and cannot be readily seized, the difficulty is easily remedied by the introduction of the finger in the rectum. These objections, therefore, fall to the ground. Fig. 113 represents Jacobson's stone-crusher, as modified by Velpeau.

With any of the above instruments the operation may, in general, be safely and expeditiously performed. The percussor of Heurteloup, is, I believe, but rarely used anywhere at the present day; it is an awkward and clumsy affair, and ought, in my judgment, to be discarded from our armamentarium.

Fig. 113.



b. Selection of Cases.—It is not every case of stone that admits of being crushed. There are certain circumstances which imperatively forbid it; and hence much judgment is frequently required to enable the surgeon to make a proper selection. When the operation was in its infancy, there is reason to believe that it was too often employed indiscriminately, both to the detriment of patient and surgeon; and, on the other hand, many persons were doubtless subjected to lithotomy, who would have made excellent subjects for lithotripsy. Fortunately, a better state of things prevails at the present day; the jealousy which once existed between the stone-breakers and the knivesmen has ceased; and the consequence is that more judgment is displayed in the selection of cases for the two operations. In this country, however, lithotripsy is still in its infancy; in fact, it can hardly be said to have received fair play at the hands of the lithotomists. Dr. Dudley, who has operated more frequently for stone than any surgeon in America, has never, I believe, employed lithotripsy; and the same is true of some of our other practitioners. Those who have busied themselves most with this operation, in this country, are Dr. Randolph, Dr. Gibson, Dr. Pancoast, Dr. J. M. Warren, and Dr. N. R. Smith, the first of whom unfortunately died too soon for the cause of surgery, which he was so nobly engaged in cultivating. Many other surgeons have occasionally resorted to it, but comparatively few have made it the subject of their special study and practice. The operation was first performed in the United States, by Dr. Depeyre, of New York.¹

The circumstances which are favorable to the operation are, chiefly, a sound condition of the genito-urinary organs, the existence of a small and comparatively soft calculus, and a good state of the general health. As it respects the parts which are immediately concerned in the operation, it is important that they should be as free from organic disease as possible, otherwise the play of the instrument will be liable not only to be impeded, but almost sure to prove injurious. There must be no stricture of the urethra; enlargement of the prostate; sacculation, ulceration, hypertrophy, or permanent contraction of the bladder; and no disease of the ureters and kidneys. Even an excess of morbid sensibility of the urinary passages is incompatible with the operation. The stone should be small, soft, and loose. A large concretion cannot be easily grasped and retained by the instrument; a very hard one

¹ New York Med. Journ. for February, 1831.

would with difficulty be crushed, and an adherent or encysted one could not be seized. The mulberry calculus is generally so firm and dense as to resist any amount of pressure that may be safely employed against it; and the uric acid concretion is frequently so large as to render it impossible to seize it. In the latter case, too, even supposing that fracture could be easily accomplished, it would hardly be proper to operate, on account of the great number of fragments which would result from the crushing, and which would thus necessitate the frequent reintroduction of the instruments; besides, they would be very apt to become a source of new irritation, and thus give rise to violent cystitis. For the same reason, the operation is inadmissible when there are a number of calculi. Finally, care should be taken, also, that the bladder does not contain much viscid mucus, lest some of the debris of the concretion be entangled in it, and so be retained, thereby endangering relapse. Serious disease of the neighboring parts, as the perineum, anus, rectum, vagina, and uterus, also contraindicates the propriety of the operation.

The general health should be good. If the patient is broken down and is dyspeptic, or harassed with flatulence, acidity, and constipation; emaciated, nervous, and irritable; or worn out by hectic; the operation is not to be thought of. If performed under these circumstances, it would be almost certain to be followed by severe local and constitutional symptoms; perhaps by fatal results.

Age constitutes no valid objection to the operation. If the general health is good; if there is no organic disease of the urinary apparatus; and if the manipulative processes are conducted with the requisite care and skill, it does not matter how old or how young the patient may be, he will have a reasonable chance of recovery. Leroy, Civiale, and others, long ago demonstrated the practicability and safety of the operation upon children of three and four years of age; and Dr. Smith, of Baltimore, has in several instances employed it successfully at a much earlier period.

Supposing the operation to be determined upon, it should never be resorted to until the system, and the parts which are more immediately concerned in it, have been subjected to a course of preliminary treatment. If the general health is good, and the bladder is laboring merely under the mechanical inconvenience produced by the stone, little, if anything, will be required beyond a few doses of aperient medicine, rest in the recumbent posture for five or six days, light diet, and the free use of diluent drinks.

Should the reverse be the case, a more thorough preparation must be instituted. As long as the general health is at all deranged, the operation will be sure to be succeeded by untoward symptoms, and the likelihood of the recurrence will be materially increased, if, conjoined with this, there is an unusual degree of morbid sensibility of the urinary passages. Under such circumstances, in addition to the ordinary means adverted to, it may be necessary to take blood from the arm, or by leeches from the perineum and the hypogastric region, especially if the patient is young and robust, and to employ the warm bath, bicarbonate of soda with hop and uva ursi tea, and anodynes by the rectum. In this manner, the part and system being quieted, the operation may be undergone with comparative impunity.

The general health having thus been amended, and the urinary organs placed in as quiet a condition as possible, the surgeon proceeds to dilate the urethra, to permit the more ready introduction and play of the lithotriptor. This usually requires but a few days, and is best accomplished with a series of silver catheters, used two or three times in the twenty-four hours. Besides the benefits just referred to, the dilatation of the canal has the advantage of accustoming the parts to the presence of instruments, and favoring the escape of calculous fragments after the operation.

c. Operation.—I can perceive no reason for administering chloroform in this operation, except in the case of children. On the contrary, I think it ought generally to be avoided. For, independently of the fact that it is usually unattended with much pain, it is a matter, I conceive, of no little importance that the patient's mind should be perfectly clear, in order that he may promptly inform the surgeon of his suffering, should any arise, whether from too rough a manipulation, too great a size of the stone, or the seizure and inclusion of the mucous membrane of the bladder. Such contingencies may, it is true, be remote; but it is well enough to be aware of them, and to guard against their occurrence. In children, on the contrary, who are unable to give any satisfactory intimation of their real feelings, anæsthesia is of great advantage. They are saved from suffering; and, being rendered perfectly quiet and tractable, the surgeon may deliberately proceed with his manipulations, satisfying himself by a thorough examination of the condition of every part of the bladder.

During the operation, the patient may lie upon his back, near the edge of the bed, or he may sit in an easy-chair, with a movable

back, as may be most convenient. Heurteloup and some others use what is called a rectangular bed, but such a contrivance may well be dispensed with, especially in private practice. If the patient is recumbent, the head and shoulders should be moderately elevated, the breech should be raised by a pillow, and the thighs should be separated and upheld by assistants. If the urine has not been permitted to accumulate previously to the amount of six or eight ounces, this quantity of tepid water should now be gently injected through a silver catheter. Care must be taken, on the one hand, that the viscus is not too empty, otherwise it will not admit of the requisite play of the lithotripter; and, on the other, that it is not too much crowded with fluid, lest it drown the stone, as it were. The lithotripter, warmed and well oiled, is now carried into the bladder, in the same manner as a common catheter. Upon reaching the organ, it will probably at once come in contact with the foreign body; but should it not do so, it must be used as a searcher until this object is attained. The instrument is next planted against the inferior wall of the bladder, the sliding blade is carefully retracted, and then, by a wriggling movement of the wrist, or a sort of sleight of hand, the concretion is engaged in the jaws of the forceps, which are at once closed upon it. Satisfying himself now that the lithotripter does not embrace the mucous membrane of the bladder, by moving its point from side to side, or turning it round, he holds it as firmly and steadily as possible with his left hand, while with the other he props the screw at the handle of the instrument, and thus slowly crushes the calculus. If the concretion is small and friable, one effort of this kind will probably be sufficient; but, in general, several will be necessary before this object is fully attained; for, even supposing that the foreign body has been pretty thoroughly broken in the first instance, there are almost always some coarse fragments left, which require separate seizure and grinding before they can be expelled.

The stone being broken, and a portion of it, if possible, comminuted, the instrument is closed and withdrawn, care being taken that no large fragments remain impacted in its jaws, lest serious injury be thereby inflicted upon the urinary passages. The patient should now be desired to void his urine, to afford an opportunity to the smaller fragments to escape; the passage of any that remain behind being favored immediately after by injecting the bladder freely and repeatedly with tepid water, through a short, large-eyed catheter. The operation, however, should be performed with all possible gentleness,

and should be desisted from the moment it becomes a source of much uneasiness or pain. The patient is now put to bed, kept upon light diet, and requested to drink large quantities of diluents, such as gum Arabic water, or linseed tea. If much pain or spasm ensue, with a frequent desire to empty the bladder, a large anodyne is given by the mouth or rectum, and recourse is had to the warm bath, with medicated fomentations to the abdomen and perineum. Retention of urine, so apt to follow the operation, is relieved with the catheter. If peritonitis is threatened, as indicated by a small, hard, and frequent pulse, and excessive tenderness of the belly, blood must be taken freely by the lancet and by means of leeches: opium and calomel must be administered internally; and the hypogastric region must be covered with a large blister, followed by emollient poultices. In short, the antiphlogistic treatment must be carried to its fullest extent.

If no untoward symptoms arise, the operation may be repeated in five or six days; otherwise it must be delayed a longer time. Too much caution cannot be used in this respect. "Slow haste" should be the motto of every judicious lithotriptist. At the end of this period, or in a week at furthest, the bladder generally becomes sufficiently quiet to admit of further manipulation, which is now borne without pain, inconvenience, or danger. Thus, the treatment is proceeded with until the bladder is thoroughly freed of foreign matter; and, in order to make sure of this, frequent recourse must be had to the sound, that the organ may be explored in every possible direction; for, should the smallest particle of the calculus remain behind, it will be certain, at no distant day, to become the nucleus of a new concretion.

The length of each sitting must depend upon circumstances. In general, it should not exceed eight or ten minutes; and, where the operation is painful, or followed by fainty sensations, it should be much shorter; for, if persisted in, under such circumstances, great mischief may be the consequence. In all cases, it is a safe rule to be governed by the feelings of the patient.

d. Effects.—The bad effects of this operation are: 1. Hemorrhage; 2. Rigors and fever; 3. Retention of urine; 4. Contusion and laceration of the prostate and urethra; 5. Cystitis; 6. Perforation of the bladder; 7. Impaction of the fragments of the stone in the urethra; 8. Peritonitis; 9. Bending and fracture of the lithotriptor.

1. A discharge of *blood* is not an infrequent attendant upon this operation. It may be very small, or so profuse as to create feelings

of alarm for the patient's safety. The blood may proceed from the urethra, the bladder, or the prostate gland, or from all these parts simultaneously; and may be caused simply by the friction of the instruments, or by actual laceration of the mucous membrane. Recumbency, cold applications to the perineum, the pubes, and the hypogastrium, and the internal use of acetate of lead and opium, or opium and gallic acid, are generally sufficient to put a stop to it.

2. There are few patients who do not suffer from *rigors* after this operation. In some instances they come on almost immediately, and in others not for several hours. They are sometimes exceedingly severe and protracted, and are always followed, in that case, by high fever and even delirium, which pass off after a while in copious perspiration. Occasionally the patient falls into a sort of collapse, from which it is exceedingly difficult to rouse him. The best remedies are, a full dose of morphia, hot drinks, especially brandy toddy, and sinapisms to the spine, extremities, and præcordial region.

3. Another frequent consequence of lithotripsy is a difficulty of passing water, amounting sometimes to complete *retention*. This may be owing to several causes, of which the most common are, the shock received by the bladder during the crushing of the stone, or a certain amount of contusion of the mucous and muscular tunics, the presence of a considerable quantity of coagulated blood, or, finally, the lodgement of a fragment of the concretion in the urethra. The symptom is not in itself of dangerous import; but it should never pass unheeded, lest the accumulation proceed too far, and thereby seriously jeopard life. Fomentations, the warm bath, and a full opiate are the proper remedies, followed, if necessary, by the catheter.

4. *Contusion* and even laceration of the urinary passages occasionally occur. This accident will be most likely to take place when there is a disproportion between the diameter of the urethra and the size of the instruments, especially if the surgeon has little experience in operating; when the patient is restless and unmanageable; when the stone is unusually large or firm; or when the lithotripter bends or breaks, so that it is withdrawn with great difficulty. Occasionally, the mucous coat is included in the jaws of the instrument, and is either severely bruised, or torn off in the form of a patch. Such an accident, although not necessarily followed by serious consequences, may generally be easily avoided by observing

the precautions adverted to in a previous paragraph. The case must be treated antiphlogistically, and by the free use of diluents.

5. One of the worst effects of this operation is *cystitis*, which generally sets in within the first twenty-four or thirty-six hours, and occasionally proceeds rapidly to a fatal termination in spite of the best-directed efforts of the surgeon. The most prominent symptoms are, a constant desire to pass water, accompanied with great pain, and a sense of scalding along the urethra; spasm at the neck of the bladder; a feeling of weight and tension low down in the pelvis; a viscid, turbid state of the urine; tenderness on pressure of the hypogastrium; and high constitutional excitement. The treatment is conducted according to the ordinary rules of surgery; by venesection, leeches, purgatives, antimonials, diaphoretics, as Dover's powder and the warm bath, fomentations, blisters, and opiate injections. These remedies are employed early, with a bold, vigorous hand.

6. *Perforation* of the bladder is an accident fortunately of rare occurrence. It has sometimes happened in the hands of the most skilful operators, as Breschet, Tanchon, and Bancâl. It is by no means peculiar to this operation, and cannot, therefore, with propriety, be alleged as an objection against it. The same thing has happened repeatedly in the operation of lithotomy. The accident is necessarily a most serious one, and should, therefore, always be carefully guarded against. Sometimes it is caused by the instrument itself; sometimes, by a fragment of the calculus, a sharp corner of which is pressed into the coats of the bladder as the lithotripter is withdrawn. However induced, the lesion is generally followed by infiltration of urine and death. Little can be done to prevent this event. The belly soon becomes tense, tympanitic, and exquisitely tender under pressure; great distress and pain are experienced in the bladder and urethra; the patient has frequent chills, alternating with flushes of heat; and the system soon sinks into a typhoid condition. Fomentations, opiates by the mouth and rectum, and internal stimulants, constitute our chief remedial resources. Depletion of every description is inadmissible.

7. A *fragment* of the broken calculus is sometimes arrested in the urethra, where it either simply produces retention of urine, or, in addition, more or less irritation of the mucous membrane. If the piece is sharp or angular, serious mischief may ensue before it is finally dislodged. The treatment varies. If the concretion is situated far back, an attempt should be made to thrust it into the

bladder; but if it has advanced considerably forward, it may be removed with the forceps.

8. Lithotripsy is sometimes followed by *peritonitis*. The occurrence, however, is rare, and is generally the result of an extension of morbid action from the bladder. It is most liable to arise in persons of a nervous, irritable temperament, from the protracted and injudicious use of the lithotriptor. It is characterized by a small, frequent, and wiry state of the pulse, a tender and tympanitic condition of the belly, difficult micturition, and inflammatory fever, followed, in a short time, by typhoid symptoms and death. The disease must be combated by antiphlogistic measures, early and vigorously plied. The pulse, being small and feeble, is liable to betray the practitioner into a state of fatal inactivity.

9. *Purulent infection*, *phlebitis*, or *pyohæmia*, is another effect which occasionally follows this operation. The occurrence, however, is rare, Mons. Civiale informing us that he has met with it only in three cases out of more than four hundred. The unfavorable symptoms, such as violent and obstinate rigors, excessive prostration, sallow complexion, dryness of the tongue, feebleness of the pulse, great restlessness, and delirium, generally show themselves from three to five days after the operation, and are often accompanied by the signs of local inflammation of some of the larger joints and internal viscera. The disease is usually very stealthy in its character, and is nearly always fatal, death occurring at a variable period after the attack. It affects persons of different ages, temperaments, and habits, but is most common in elderly subjects, and in such as have been enfeebled by dissipation and protracted indisposition. The phosphatic diathesis and disease of the genito-urinary organs may be regarded as predisposing causes. After death, deposits of matter are found in the cellular tissue of the extremities, in the joints, and in some of the internal organs, especially the kidneys, liver, and lungs. The veins often exhibit traces of inflammation, and small abscesses are occasionally found round the neck of the bladder, in the areolar substance of the pelvis, and in the reflections of the peritoneum.

Very little is to be expected, in this disease, from treatment. Our principal reliance must be upon mercury, opium, and quinia, in adequate doses to affect the system, in brandy, wine, and porter, in the application of blisters, and in free incisions, to give vent to effused and pent-up fluids.

10. Great embarrassment and mischief sometimes result from the

bending or *fracture* of the stone-crusher. Cases are recorded, in which, in consequence of these accidents, the instrument was obliged to be sawed off on a level with the head of the penis, and then extracted either by an opening through the perineum, or above the pubes. A few of the patients thus treated have recovered, but the majority have perished from the effects of their injuries. An ounce of prevention in such a case is worth a pound of cure. No instrument, liable to such a contingency, should ever be employed for so important an operation. Both the surgeon and his cutler should be held personally responsible for it.

e. Comparative Value.—It is impossible, in the existing state of the science, to form anything like a correct estimate of the comparative value of lithotripsy and lithotomy. Excepting in France, crushing is so rarely performed that no means for instituting such an estimate have yet been furnished, and in that country the only elaborate data are those supplied by Mons. Civiale, the great champion of the operation. From these, it appears that relapse followed in fifty-five cases out of five hundred and forty-eight, being in the proportion of nearly one to ten. This is unquestionably much greater than in lithotomy, and affords a strong argument against the general introduction of the operation, even in the most favorable cases. The proportion of relapses after lithotomy is supposed, by Mr. Coulson,¹ to be one in sixty; but this, I am sure, is far too favorable, although borne out by the data upon which he has based his estimate. The reasons for this statement will be shown in the article on lithotomy.

The cause of the frequent relapse after lithotripsy is no doubt the fact that fragments of the broken stone are more liable to be left in the bladder, which thus become, often in a very short time, the nuclei of new formations. In lithotomy, on the contrary, the concretion is generally removed whole, and any pieces that may be split off are either extracted at the time, or they are washed away subsequently by the urine as it flows through the wound, the patency of which, for a certain time, greatly favors this mode of clearance. The most remarkable instance of relapse after lithotripsy, of which I have any knowledge, has been recently recorded by Mr. Coulson.² It occurred in a man, aged eighty-three, on whom, during a period of twenty years, the operation had been performed forty-eight times.

¹ London Lancet for March, 1854, p. 278. Amer. ed.

² *Op. cit.* p. 277.

f. Mortality.—The mortality of lithotripsy has not yet been satisfactorily determined. In this country, where the operation has been seldom performed, and where, if it be not on the wane, it is certainly not on the increase, no contributions have been made to its statistics, and the same is true in respect to Great Britain. The late Mr. Key, of London, Sir Philip Crampton, of Dublin, and Mr. Teale, of Leeds, are the only surgeons who have published the results of their entire experience; but, unfortunately, their cases are too few to justify us in making any use of them for the purposes under consideration. France has had a number of lithotriptists; but Mons. Civiale, who, at the present day, exercises almost unlimited sway in this particular department of surgery, is almost the only one who has furnished the profession with an account of his operations. The veracity, however, of his statements has been repeatedly called in question, especially by his own immediate neighbors, and it is therefore impossible to determine the amount of credit to which they are entitled. It is hardly possible to suppose that a gentleman who occupies so exalted a position, and who is so constantly under the surveillance of the numerous corps of practitioners in Paris, should, even if he felt inclined, commit so suicidal an act. Such a course, in this country, would be fatal to any man, and would justly bring upon him the indignation of the whole fraternity. We take it for granted, without knowing him personally, that Civiale has been guilty of no such folly, and that the reproaches which have been cast upon him, in this respect, are unmerited.

In Italy, lithotripsy received at one time considerable attention, but it never, either in that country, or in any other portion of the continent of Europe, made the same progress that it has in France. In Germany, as I have been recently informed by Dr. Victor V. Ivánchich,¹ of Vienna, the operation was still in its infancy thirteen years ago. Within that period, that distinguished surgeon has performed it nearly one hundred times, and, in almost every instance, successfully. Of his first twenty-four cases, he lost only one. He has crushed a greater number of stones than any other surgeon in Northern Europe.

¹ Dr. Ivánchich has published several brochures upon lithotripsy, which he has been kind enough to send me.

Table showing the Results of 917 Cases of Lithotripsy.

Operators.	Cases.	Cures.	Deaths.	Relieved.	Proportion.
Civiale . . .	581	567	14	...	1 in 41½
Leroy . . .	116	105	11	...	1 " 10½
Cazenave . . .	52	48	8	1	1 " 6½
Keith . . .	16	14	1	1	1 " 16
Campanella . . .	10	10	0	...	0 " 10
Fergusson ¹ . . .	18	6	5	7	
Key . . .	12	5	3	4	
Italian operators .	112	103	9	...	1 " 12½
	917	853	51	18	1 in 18

Although I have no disposition to doubt the truth of Mons. Civiale's statements respecting the mortality of his operations, I deem it my duty to subjoin, in tabular form, the rigorous analysis of his earlier cases, by Mons. Velpeau.² It is proper to add that this writer has arranged these cases into five series.

Series.	Cases.	Cures.	Deaths.	Unrelieved.
First	83	41	39	3
Second	24	13	11	0
Third	53	30	15	8
Fourth	30	18	8	4
Fifth	16	6	7	3
	206	108	80	18

In reading the account of Civiale's cases, we are forcibly struck with the great proportion of old patients, and the remarkably small number of children. Thus, out of 512 cases, in which the ages are given, 25 were from one to twenty years, 80 from twenty to forty, 124 from forty to fifty, 44 from fifty to sixty, 234 from sixty to eighty, and 5 from eighty to ninety.

ART. V.—LITHOTOMY.

It would be an endless task to give an account of the various operations of lithotomy, as they have been practised by different surgeons in different ages and in various parts of the world. Such an undertaking might prove an agreeable literary pastime, but as a practical effort it would be unproductive of any useful results.

¹ It is proper to state that Mr. Fergusson was not the operator in a moiety of these cases; see Edinb. Med. and Surg. Journal for Oct. 1838.

² Médecine Opératoire, 2d ed. t. iv. p. 649.

The elaborate and learned work of Deschamps, moreover, renders such a labor unnecessary, inasmuch as it supplies everything of interest, or value, in relation to these operations, from the earliest time to the present; and all, or nearly all, that modern science has contributed to the subject, has been fully embodied by his commentator and continuator, Dr. L. J. Bégin. Referring the reader, therefore, to the treatise of the celebrated Frenchman, justly regarded as an immense storehouse of erudition and research, I shall content myself here, after a brief sketch of the Celsian and Marian methods, the parents of them all, with an account of a few of the more important operations, as they are performed by the most eminent surgeons of the present day. These are the lateral, bilateral, supra-pubic, and recto-vesical.

GENERAL OBSERVATIONS.

Lithotomy may be performed at any period of life. Experience, however, has established the interesting and important fact that the greatest number of recoveries take place in children and in subjects under thirty years of age. Persons after this time of life are more prone to suffer from inflammation of the urinary apparatus, and, perhaps also, from erysipelas of the wound, and phlebitis of the neck of the bladder and prostate gland. Upon this circumstance surgeons are, I believe, generally agreed, though they are unable to assign any reason for its occurrence. It would be desirable to present a subject of so much interest in a perfectly satisfactory light, divested of all doubt and uncertainty; but for this we have unfortunately no statistics, which can alone settle the point.

Lithotomy has sometimes been performed at a very early age. Civiale refers to a child that was cut at ten weeks; Mr. Keate, of St. George's Hospital, London, operated in two cases at twelve months; Mr. Key,¹ in one at sixteen months; John Hunter, in one at eighteen months; and Mr. South,² in one at twenty months. The youngest child I have cut was a little over three years. Infancy and childhood are peculiarly propitious for the operation. The disease, at this period, is usually free from complication, both local and constitutional; the wound made by the knife readily heals;

¹ "I have cut a child for stone at the early age of sixteen months; and have assisted at an operation where the patient had only completed its thirteenth month."—*Guy's Hospital Reports*, vol. ii. p. 17, 1837.

² *Chelius's Surgery*, vol. iii. p. 297, Amer. ed.

traumatic fever seldom runs high; and there is little or no danger of urinary infiltration, erysipelas, phlebitis, or peritoneal inflammation. Another advantage is the absence of mental anxiety, and anticipation of an unfavorable issue, a circumstance which often exerts an unhappy influence upon lithotomy in adults.

Old age is no bar to an operation, provided the patient is otherwise in a good condition. In 1843, I cut a gentleman, aged seventy-seven years, a resident of one of the border counties of Kentucky, and extracted from his bladder not less than fifty-four calculi, from the size of a large pea to that of an ordinary marble. He recovered promptly from the effects of the operation, but died suddenly, six weeks afterwards, from an attack of apoplexy. Mr. Attenburrow, of Nottingham, England, operated successfully, in one instance, upon a man of eighty-five; and, in another, upon a man of eighty-seven. Mr. Cline, of London, cut a patient at eighty-two; Mr. Coulson, one at eighty; Sir Astley Cooper, one at seventy-six. Chief Justice Marshall, of the Supreme Court of the United States, was lithotomized at a very advanced age, by the late Dr. Physick, of Philadelphia, who extracted upwards of a thousand concretions, from the volume of a partridge shot to that of a bean. The recovery was rapid and complete, and the patient lived a number of years afterwards in the enjoyment of excellent health.

It need hardly be said that every patient, about to undergo lithotomy, should be subjected to a certain degree of preparatory treatment, in order to place him in the best possible condition to bear the shock and other ill effects of the operation. There is no doubt that much of our success depends upon the manner in which this is done. The amount of this preliminary treatment must necessarily vary in different cases, and does not, therefore, admit of precise specification. When the patient is in good general health, as is evinced by the state of his complexion, appetite, sleep, and digestion, he will seldom require anything more than a dose or two of aperient medicine, and abstinence from animal food, with rest in his room. Four or five days will, in fact, generally suffice to put him in a proper condition for the operation. But it is very different when he is in bad health. Here a more thorough course of preparatory measures is necessary. The secretions must be rectified, the bowels must be opened by mercurial and other cathartics, the diet must be regulated, and, in a word, all sources of excitement, local and constitutional, must be removed. When these

objects have been attained, then, and not until then, will it be proper to subject the patient to the knife. Too much preparation, however, should be avoided; for it is as bad as too little; indeed, if anything, worse. To starve and purge a patient to death before an operation is as bad as to kill him after it.

No surgeon having a proper regard for his own character and the dignity of his profession, would be likely to operate in case the patient is affected with organic disease of the lungs, or of any other important viscera. Serious lesion of the kidneys, ureters, bladder, and prostate gland also forbids interference. In short, whenever the health is much impaired by previous suffering, not solely dependent upon the presence of the urinary concretion, the judicious surgeon will hesitate not a little before he will resort to the knife.

Persons affected with *Bright's disease* are particularly bad subjects for operations of stone in the bladder, by whatever method they may be executed. Numerous cases, in which the result was unfavorable in consequence of the co-existence of these affections, have occurred within the last fifteen years, and should serve as a warning to the lithotomist against any interference of the kind in similar circumstances. The existence of this form of renal disease may not, in its earlier stages and milder grades, militate against the performance of an operation; but at a later period no interference whatever is justifiable; the prognosis is unfavorable, and no care that can be bestowed upon the patient will be likely to save him. Fortunately, the means of verifying the presence of this disease, even at a very early period, is no longer a matter of doubt or difficulty. The scanty quantity, diminished density, and highly coagulable condition of the urinary secretion, the feverish excitement of the system, the steady wasting of the flesh and strength, the pain and tenderness in the lumbar region, the frequent micturition, and the tendency to, or actual existence of, dropsical effusion in various parts of the body, are unmistakable signs of the concomitancy of the two affections.

Ulceration of the *bladder*, especially when at all extensive, should be considered as an absolute barrier to the operation of lithotomy; for few patients, cut under such circumstances, will recover their health, or, if they do, remain permanently well. Such an affection may be suspected when there is a constant discharge of pus andropy mucus, a frequent desire to urinate, with excessive pain and burning in the bladder, an alkaline condition of the urine, severe distress in the lumbar region, the perineum, and the anus, and steady

failure of the general health. It is to be remembered, however, that the pus may proceed from other portions of the urinary apparatus, as the prostate gland, the ureters, or kidneys, and hence its value as a diagnostic phenomenon is much impaired.

Serious disease of the *prostate* gland is another circumstance contra-indicating the operation; but, as it is comparatively infrequent, few patients are lost from this cause. Old subjects are most liable to suffer in this way, and in them the diagnosis is generally sufficiently easy, especially when the lesion consists of hypertrophy, or is complicated with that affection.

Tubercular disease of the *lungs* is generally, and, indeed, very justly, regarded as a reason for non-interference with the knife in calculus of the bladder. I should certainly hesitate to cut a patient for stone even in the earliest stage of this affection, while I should consider such a procedure as utterly inadmissible after the deposit has made considerable progress. M. Belmas¹ and other writers refer, it is true, to cases which seem to show that tubercular phthisis may not only be arrested but even cured by the operation; but if this be the fact, it only proves that patients will occasionally recover under very adverse, if not desperate, circumstances, and I should be very sorry to see a rule of practice established upon such a slender basis. The same connection exists here between the bladder and the lungs as between the anus and the lungs in fistule: in both cases the pulmonary disease is retarded, countervailed, or entirely suspended by the remote affection, which thus plays the part, at least for a while, of a pyogenic counter-irritant. The moment the counter-irritation is removed, or the source of the remote discharge dried up, the tubercular malady acquires new life, and steadily progresses until it effects the patient's destruction. There are exceptions to all rules, though it is not always easy to discover and apply them at the bedside.

§ 1.—OPERATION OF CELSUS, OR APPARATUS MINOR.

The earliest operation of lithotomy of which we have any knowledge was described by Celsus, on which account, although it was never practised by him, it generally bears his name. From the manner in which the stone was fixed by the fingers, introduced into the anus, it is also known as the operation of cutting on the

¹ *Traité de la Cystotomie Sus-Pubienne*, p. 299.

gripe, and, from the small number of instruments required, as the apparatus minor, in contradistinction to the apparatus major, presently to be noticed. The operation was first performed by Ammonius, at Alexandria, in the time of the anatomists Herophilus and Erasistratus; it was generally restricted to children between the ages of nine and fourteen, and, strange to say, was the only method used until the commencement of the sixteenth century. The only instruments required were a knife and a hook, semicircular in its form, smooth on the back, and rough within.

The rectum having been cleared out by an enema a short time previously, the patient was requested to walk about the room to propel the stone towards the neck of the bladder. He was then placed upon the lap of an assistant, who held him in such a manner as to separate the thighs, and thus expose the breech to the greatest advantage. The surgeon, gently compressing the pubic region with his right hand, introduced the left index and middle fingers, well oiled, into the rectum, behind the stone, which was next drawn down as far as possible, and firmly fixed in its position. A lunated incision was now made over the most prominent portion of the perineum, the convexity looking forwards to the bulb of the urethra, and the concavity towards the anus, the extremities being directed towards the ischiatic bones; or, in the words of Celsus, *cornibus ad coxas spectantibus paulum*, very much as in the bilateral section of the present day. The knife being reinserted into the wound, the deep structures of the central part of the perineum were divided down to the neck of the bladder, upon the stone, which was next pressed out through the opening, or extracted with the hook.

No statistics have been transmitted to us of the results of the lesser apparatus. That the operation, even in the hands of the most experienced and skilful lithotomists, was eminently unsuccessful, we have abundant reason to believe, from the fact that, as soon as a better knowledge of anatomy began to prevail, it fell into merited neglect. It was not only, to borrow an expression from Dionis, exceedingly dolorous, but very tedious, and often followed by the worst consequences, such as infiltration of urine, sloughing of the wound, vesico-rectal fistule, peritonitis, and death. Civiale, in his *Treatise on Calculous Diseases*, states that the apparatus minor was performed sixteen times in Lombardy, with a loss of two, or in the ratio of one to eight. Such statistics are, of course, of no use in trying to form an estimate of the value of an operation.

§ 2.—MARIAN METHOD, OR APPARATUS MAJOR.

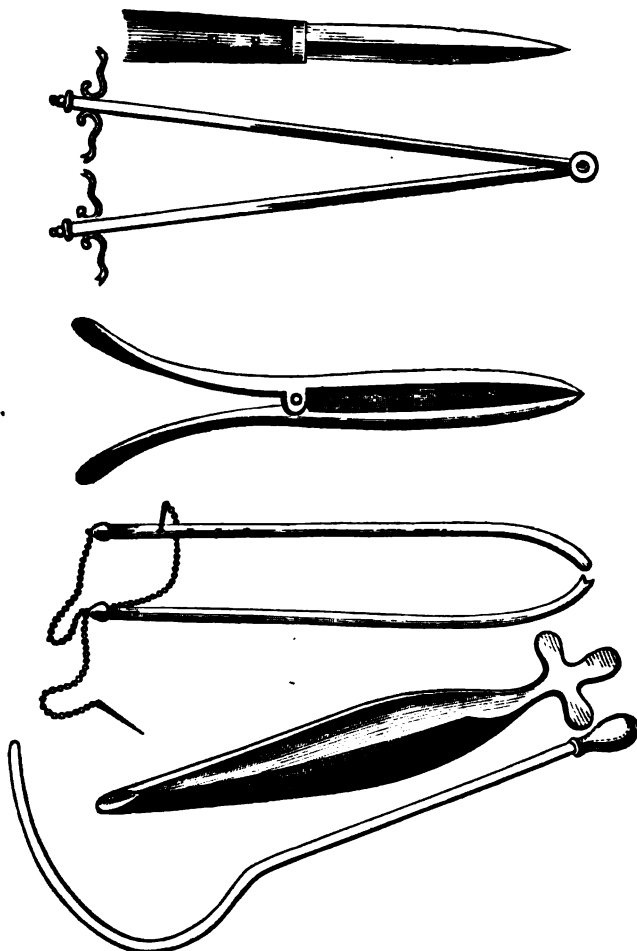
The apparatus major, so called from the multiplicity of the instruments employed in its execution, was devised in 1520 by John de Romanis, a surgeon of Cremona, with a view of facilitating the extraction of calculi from adults, the apparatus minor having been, as before stated, restricted chiefly to children. The first account of it was published by his pupil, Marianus Sanctus, who practised medicine at Rome and Padua, in his work, entitled *Libellus Aureus de Lapide à Vesicâ per Incisionem Extrahendo*. Hence it has sometimes been called the Marian method. The term "median" has also been applied to it, from the fact that the incisions were made along the raphé of the perineum. The operation, notwithstanding its rash and unscientific nature, remained in vogue until the latter part of the seventeenth century, when it was superseded by the method of Frère Jacques, whose dissections and operations paved the way which was afterwards so successfully explored by Cheselden and other lithotomists.

The apparatus major was founded upon the erroneous precept of Hippocrates, which inculcated that all wounds of membranous parts are necessarily mortal. To prevent this supposed occurrence, de Romanis proposed, after having divided the external structures, to dilate the membranous and prostatic portions of the urethra, along with the neck of the bladder, by means of particular instruments, which, together with his knife and staff, are delineated in the annexed cuts (Figs. 114 to 119). The patient being placed in the position usually adopted at the present day, with his hands and feet firmly secured by fillets, a grooved staff was introduced into the bladder, and an incision, commencing just below the scrotum, and terminating near the verge of the anus, was made along the middle line of the perineum. By successive strokes of the knife, the operator cut the muscles of this region, and carefully exposed the bulbous portion of the urethra. This being next divided, the instrument was laid aside, and the process of dilatation begun. For this purpose he used two conductors, a male and a female, which, being guided into the bladder along the staff, were pressed in opposite directions until the track was sufficiently capacious for the passage of the forceps and the extraction of the foreign body.

It is generally supposed that the apparatus major, instead of dilating the parts, as it proposed to do, cruelly lacerated them, thus

subjecting the patient to much pain and the risk of urinary infiltration. However this may be, it is certain that it was attended by

Figs. 114—119.



Instruments constituting the Apparatus Major.

the most frightful mortality in the hands of its inventor, and of his more immediate successors. In modern times it has been performed with more favorable results, as the table under the head of statistics will serve to show.

Although the apparatus major is not, so far as I know, any longer performed at the present day, it is interesting, both in an historical and practical point of view, to ascertain the rate of its

mortality during the height of its renown in the principal French hospitals. With this view, I have compiled from the works of Morand and Civiale the subjoined table, which, it is believed, comprises all the statistics of the kind extant.

Table showing the Results of 1,986 Cases of the Apparatus Major.

Locality.	Cases.	Cures.	Deaths.	Proportion.
La Charité } Paris, . . .	208	187	71	1 in 2 $\frac{1}{4}$
Hôtel-Dieu } 1720 to 1728 ¹ .	604	420	184	1 " 8 $\frac{1}{4}$
La Charité, Paris, 1781 to 1785 ²	71	89	82	1 " 2 $\frac{3}{4}$
Lunéville Hospital, France .	1,108	984	119	1 " 9 $\frac{1}{11}$
Total . . .	1,986	1,580	406	1 in nearly 5.

It will be seen by this table that the mortality from the operations at La Charité and the Hôtel-Dieu was considerably greater at the former than at the latter; a circumstance the cause of which has not been explained. At La Charité, indeed, the number of deaths during two of the eight years exceeded the number of recoveries. Thus, in 1721, twelve out of twenty-three died, and in 1725 sixteen out of twenty-nine! It is to be regretted that we are not acquainted with the names of the operators, the condition of the patients prior to the use of the knife, and the various other circumstances influencing the results of the employment of this method. Le Dran,³ who cut sixteen patients publicly at La Charité in 1728 and 1729, did not lose a single one, notwithstanding that the calculus in several of the cases weighed from six to eight ounces. The success at the Lunéville Hospital was most remarkable, and compares very favorably with that of the lateral section, as performed at the present day.

§ 3.—OPERATION OF FRÈRE JACQUES, RAU, AND OTHERS.

The operation of Frère Jacques deserves brief notice, as it forms, as it were, the connecting link between the apparatus major and the perineal section in vogue at the present day. It constitutes, in fact, a most interesting and brilliant epoch in the history of lithotomy, whether it be viewed simply with regard to its originality, or in its more important relations to the improvements of surgery, and

¹ Morand, *Traité de la Taille*, p. 268. Paris, 1728.

² Morand, *Opusculs de Chirurgie*. Paris, 1768.

³ *Parallèle des Tailles*, par Le Dran, partie i. p. 660.

the welfare of the human race. The author, himself, was a most remarkable personage, well calculated to arrest attention, and excite curiosity. Born of poor parents, in 1651, at Etendonne, a village in Franche Comté, he became at an early age, with hardly any preliminary education, the pupil of Pauloni, an itinerant lithotomist. His progress must have been rapid, for it is related of him that he soon began to practise on his own account. His first trials were made at Besançon, at a hospital erected for the support of children and aged persons. A number of his cases being successful, his fame spread through the surrounding country, and served to attract patients from abroad.

In his fortieth year, Frère Jacques resolved to become a monk, and to devote himself, during the remainder of his life, to works of charity. Thirsting for a larger field of usefulness, he was induced, by the advice of his friends, to visit Paris, where he arrived in 1697. Introduced to the physicians and surgeons of the Hôtel-Dieu, he operated in their presence, upon the dead subject, Méry, one of their number, being appointed reporter. The instruments employed on the occasion were, a steel staff, without, according to some, a groove, a dagger-shaped knife, a conductor, and a pair of forceps. Cutting through the left side of the perineum, between the accelerator and the erector muscles, he divided the body of the prostate gland, and the whole neck of the bladder, as well as a little of the body of the organ, and readily extracted the stone, which had been introduced for the purpose. The report of the judge was favorable; not so, however, after the second operation, performed a short time after. On dissecting the body, Méry found that the parts had been greatly injured, and that the bladder had been almost torn from its connections with the pubic bones. The result was that Frère Jacques drew upon himself the opposition of the entire hospital faculty, and he was, therefore, not permitted to operate upon the living subject.

Disappointed in his expectations, he quit Paris, and went to Fontainebleau, the seat of the French court; where, encouraged and patronized by M. Felix, surgeon to the king, he soon obtained business, cutting twelve patients with a loss of only two. Success so extraordinary gave a new impulse to his claims, and silenced for a while the clamors of his enemies. Recalled to Paris by an order from President De Harlay, he performed several operations, and was at length intrusted with all the calculous patients at the Hôtel-Dieu and La Charité, the only hospitals at that period in the

French metropolis. Misfortune, however, again awaited him, and, for a time, completely destroyed his reputation; for out of sixty persons whom he lithotomized at these institutions, twenty-five died, as many as seven being carried out of one of them in a single day; whereas, of twenty-two cut by the regular attendants, only three died. His career was now apparently at an end; his enemies had once more gained the ascendancy, and the pious brother, ejected from the hospitals, left Paris in disgust.

The ill success of Frère Jacques was owing mainly to his ignorance of anatomy, the study of which he had hitherto wholly neglected, but which he now pursued with much zeal, under Duverney and Winslow, at Versailles. He had hitherto proceeded, as it were, in the dark, like a navigator without compass and rudder to guide him in his voyage. He saw his error, and used his best efforts to correct it. Fortified with a thorough knowledge of the perineum, the urethra, prostate gland, and bladder, and armed with improved instruments, he sallied forth through the chief towns of France, and finally penetrated Holland, Germany, and Italy, gaining the favor of the profession, and the applause of the public by the brilliancy of his achievements. His success was complete. At Amsterdam, the magistrates, impressed with a profound sense of the value of his services, voted him a costly gold medal, bearing on one side his bust, and on the reverse, the arms of the town, with the motto, "*pro servatis civibus*." Other testimonials were showered upon him at different places; and had riches been his object, he might have acquired any amount; but he despised money, and never accepted any more than was sufficient to pay for sharpening his instruments and mending his shoes. His habits were eminently abstemious, and he spent most of his time in acts of benevolence. Towards the close of his life, he went to Rome, to receive the benediction of the Pope, and, returning to his native village, he expired in June, 1719, in the sixty-ninth year of his age. It is said that he operated on nearly five thousand patients. At one time he cut thirty-eight, without losing a single one.

The next great lithotomist was Rau, Professor of Anatomy at Leyden, and a contemporary of Frère Jacques, whose exploits he witnessed during the visit which the latter made to Holland. Having an intimate knowledge of the structure of the parts interested in the extraction of the stone, he operated with extraordinary dexterity and eclat. Strange to say, however, he refused to reveal to any one his mode of proceeding, and the secret of his success, there-

fore, died with him. Laurence Heister, a pupil of Rau, afterwards Professor of Physic and Surgery at the University of Helmstadt, declares that, when his teacher came to that part of his course on operative surgery which related to lithotomy, his remark was "that he had nothing to say upon that head, because it was the means by which he subsisted and got his living, and I had rather," he added, "be silent than propose anything that might mislead you from the truth; but, if you can learn it by seeing me perform it upon living subjects, you are welcome, and for the rest you may read Celsus." It is generally supposed that Rau, in his operation, divided the same structures as Frère Jacques, in his more scientific attempts, but that he cut the prostate gland and neck of the bladder from behind forward, instead of from before backward. His patient was placed in the same position, and he used a grooved staff and two ensiform conductors, a male and female. Rau asserted that he had cured 1,547 patients by his operation; a statement denied by Camper, and other authorities.

The success of Jacques and Rau induced the surgeons of London to study their methods, for the purpose of naturalizing them in England. Bamber and Cheselden, who had hitherto been wedded to the high operation, made their first trials of the lateral section, as modified and improved by these lithotomists, in 1726, at St. Bartholomew's and St. Thomas's Hospitals. The result of Bamber's case has not transpired; but the operation of his *confrère* is well known as Cheselden's "First Operation." In this proceeding, which differed but little from the one now generally practised, the incision was commenced about an inch above the anus, on the left side of the raphé, between the accelerator and erector muscles, and carried obliquely downwards and outwards, by the side of the sphincter, to an extent varying from two and a half to four inches. The instrument, a pointed knife with a convex edge, was thrust at one stroke through the skin and cellulo-fatty matter of the perineum. The left index-finger was then inserted into the bottom of the wound, to keep the rectum to the right side, when, taking "the crooked knife with the edge on the concave side," he pushed the point of it into the bladder, between the seminal vesicle and the ischium, finishing the operation by cutting upwards. If the wound was not sufficiently large, he preferred an additional incision to laceration with the finger. When no accident happened, not more than a minute generally elapsed between the beginning of the first incision and the extraction of the calculus.

The account given by Cheselden himself of his first operation is as follows: "Hearing of the great success of Mr. Rau, Professor of Anatomy at Leyden, I determined to try, though not in his manner, to cut *directly* into the bladder; and, as his operation was an improvement of Frère Jacques, I endeavored to improve upon him by filling the bladder, as Douglas had done in the high way, with water, leaving the catheter in, and then cutting on the outside of the catheter into the bladder, in the same place as upon the gripe, which I could do very readily, and take out a stone of any size with more ease than in any other way. My patients, for some days after the operation, seemed out of danger; but the urine which came out of the bladder, continually lodging upon the cellular membrane on the outside of the rectum, made fetid ulcers, attended with a vast discharge of stinking matter; and from this cause I lost four patients out of ten." It is evident from this passage that Cheselden cut into the antero-lateral part of the bladder, without dividing the prostate gland at all, or only to a slight extent.¹

§ 4.—LATERAL OPERATION.

Of the different operations for stone, the lateral, perineal, or infra-pubic, as it has been variously termed, is by far the most important, not only on account of its greater frequency, but also on account of the remarkable success which has hitherto attended it. In the description which I am about to give, I shall speak of it as I am myself in the habit of executing it, premising that this does not differ, in any essential particular, from the method devised and so happily practised by Cheselden and his disciples.

The design of the lateral operation is to make an opening on the left side of the perineum, extending from the surface of the skin through the neck of the bladder and the prostate gland, and large enough to admit of the easy extraction of the foreign body. It is usually described as consisting of three steps, or stages. In the first, the surgeon divides the skin, the cellulo-adipose tissue, and the superficial fascia; in the second, the transverse muscle, the triangular ligament, and the membranous portion of the urethra; and in the third and last, the prostate gland, and the neck of the bladder.

The wound made in the operation may be said to represent a

¹ *Anatomy of the Human Body*, p. 328. Boston, 1806.

truncated cone, the apex of which corresponds with the neck of the bladder, and the base with the surface of the perineum. In the adult, its extent externally varies from three inches to three inches and a half, while internally it does not, as a general rule, exceed eighteen or twenty lines. Its superior angle is an inch and a quarter above the verge of the anus, and immediately on the left side of the raphé of the perineum; the inferior, on the contrary, is usually about three-quarters of an inch to an inch below the anus, and a little nearer to the tuberosity of the ischium than to the outlet in question. The inner wall of the wound corresponds with the middle line of the perineum; the external, with the ramus of the ischium and the erector muscle of the penis.

a. Mode of Operating.—The evening before the operation, a brisk purgative is administered, to clear out the alimentary canal. The article which I usually select for this purpose is castor oil; but if there be disorder of the secretions, as indicated by the state of the tongue and stomach, a combination of calomel and rhubarb with a few grains of jalap is to be preferred. If it appears probable that the rectum has not been thoroughly evacuated, a stimulating enema, consisting of tepid salt water, or strong soapsuds, is used a few hours before the operation. I consider it of paramount importance, both as it respects the safety of the lower bowel, and the comfort of the surgeon, that this precept should be faithfully attended to in all cases. Moreover, by opening the bowels freely immediately before the operation, there will be no necessity, as a general rule, for any purgative medicine for two or three days after. The operation should always be performed late in the morning, in order that the surgeon may have a good light, not only at the time, but subsequently, if any untoward occurrence should arise, such as hemorrhage. The patient's breakfast on the day of the operation should be as light as possible, especially if it be designed to give him chloroform.

The patient is requested to retain his urine for several hours before the operation; for a certain degree of distension of the bladder is necessary to prevent injury of its walls, and facilitate the extraction of the foreign body. If he be a child, and cannot hold his water without great difficulty, a piece of tape should be tied loosely round the penis; otherwise he will be sure to disobey an injunction which every lithotomist must regard as of no little consequence. In old subjects, affected with excessive irritability of the

bladder, with a constant desire to micturate, it is necessary to inject the organ with a few ounces of tepid water just before commencing the operation.

During the operation the patient lies upon his back on a narrow breakfast-table, about four feet in length, and provided with stout, firm legs, to prevent it from shaking. It is covered with a folded blanket or comfort, over which are spread, first, a piece of soft oil-cloth, and next, a folded sheet. Several pillows are required for the head and shoulders, which, however, should be but slightly raised, otherwise the abdomen will be doubled up, and unduly compress the bladder. Much elevation of the head is also improper in case chloroform is administered. The breech is fully exposed to the operator, and is therefore brought low down, a little over the edge of the table. His head and trunk are held by assistants, one of whom administers chloroform.

Two stout worsted bands, from six to eight feet in length by two inches and a half in width, are required to bind the patient's limbs. They should each have a hole in the middle to afford greater security against their slipping; or they may be arranged as in Fig. 120. As a preliminary step, the patient, stripped to his shirt, and placed upon the table, is desired to grasp his feet in such a manner as to apply his fingers to the sole and the thumb to the instep; in which position they are confined by means of the fillets, passed round them in the form of the figure 8, the ends being tied in a double knot, or fastened with stout pins. This duty is generally

Fig. 120.



confided to the assistants, for which reason it is often discharged so badly as to be followed by much delay and annoyance; the patient, perhaps, becoming untied during the operation. A careful supervision should, therefore, always be exercised in this respect by the surgeon.

The limbs, bound as here directed, are given in charge of two assistants, who, one standing on each side of the patient, place one hand upon the top of the knee, and the other beneath the sole of the foot. When the operation is about to be commenced, the thighs are moderately separated from each other, and held nearly at a right angle with the trunk. It can be easily perceived how important it must be, in reference to the speedy and successful execution of the operation,

that the patient's limbs should be thoroughly controlled, and out of the surgeon's way.¹

It is usually recommended that the staff be introduced previously to the ligation of the patient; but to such a procedure I am altogether averse, because it is productive of serious annoyance to the patient, and is almost sure to be followed by a premature escape of the urine. Besides, it is a source of inconvenience to the persons who have charge of the limbs. My rule, therefore, always is to tie the patient first, and immediately after to introduce the staff; taking care to confide it to a good, intelligent assistant, one who is thoroughly acquainted with the anatomy of the pelvis, and the different steps of the operation. A poor staff-holder is a great curse; for he often excessively embarrasses the surgeon, and makes him commit blunders which he might otherwise avoid. During the operation, the instrument is to be held perpendicularly, with the handle nearly at a right angle with the trunk, and inclined *slightly* towards the right side. The curved portion, securely lodged in the bladder, is hooked up closely against the pubic symphysis. The object of this advice is to prevent the instrument from pressing upon the rectum, which would thus be in danger of being wounded. By inclining the handle of the staff a little towards the right groin, the curved portion is made to bear against the left side of the perineum, with the effect of rendering it somewhat prominent and thereby facilitating the division of the membranous portion of the urethra. The assistant having charge of the instrument, stands on the left side of the patient, in order that he may use his right hand, and also holds the scrotum out of the way.

The staff (Fig. 121), made of steel, and shaped like an ordinary silver catheter, is about ten inches in length, exclusive of the handle, which should be at least two inches long by two lines and a half in thickness and fifteen lines in width, and perfectly rough on the surface, that it may be the more securely held in the hand.² The groove, placed a little towards the left side, and extending from near the middle of the instrument to within a short distance of its beak,

¹ Desault mentions a very singular case in which a patient broke both his patellæ at the same moment, by a violent effort of the muscles to disengage the limbs from the confined situation in which they were placed during the operation of lithotomy.

² The late Mr. Key, of London, was in the habit of using a straight staff, but I do not know that any one, at least in this country, has imitated him in this respect. It is said that he always cut on the instrument, in a way peculiar to himself, with great ease and dexterity.

should be perfectly smooth, and as deep and as wide as possible. It is warmed and oiled, previously to its introduction, like an ordi-

Fig. 121.

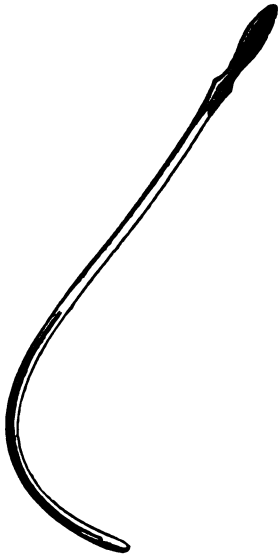


Fig. 122.



Fig. 123.



Fig. 124.



nary catheter, and should be large enough to distend the urethra to as great a degree as is compatible with the patient's comfort. By adopting this advice, the surgeon will find it comparatively easy to find the staff, and effect, in a safe and proper manner, the division of the neck of the bladder and the prostate gland.

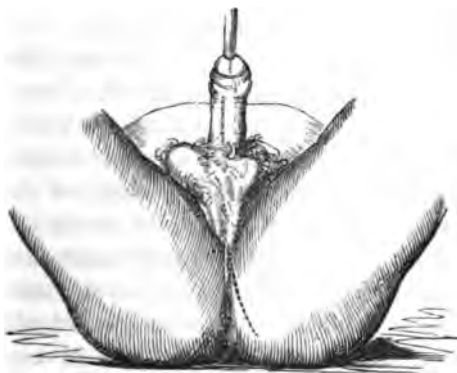
The surgeon, during the operation, sits upon a low, firm chair, or stool, as he may find it most convenient. Or he may put himself, as I am wont to do, in the half-kneeling posture, resting upon the right knee. I generally prefer this posture, because it affords greater freedom to my hands and elbows, by placing them, as it were, in a more depending situation. To protect his person and clothes from

blood, urine, and feces, he should wear a long India-rubber apron. A piece of old carpet, or a sheet, is laid upon the floor, under the patient's breech, to receive the fluids.

The knife which I have been in the habit of using, during the last three years, is the one sketched in the adjoining cut (Fig. 122); it is of simple construction, very light and slender, sharp-pointed, and nearly seven inches in length, of which three are occupied by the blade, which hardly exceeds two lines in width. Until the period here specified, I had never used any other knife than that of Liston (Fig. 123), which, in its main features, closely resembles that employed by Martineau, and some other English lithotomists, except that the cutting edge does not extend beyond two inches in length. With either of these instruments, the lateral operation may be safely and expeditiously executed in all its stages. For enlarging the opening in the prostate and neck of the bladder, after the withdrawal of the staff, I sometimes use the probe-pointed bistoury, delineated in Fig. 124, though the instrument first described is quite as safe, provided the extremity be carefully guided along the index finger as it lies in the bottom of the wound.

Everything being thus prepared—the rectum cleared out, the instruments arranged on a tray, the limbs tied and held out of the way, the staff in the bladder and in the hand of the assistant, the breech

Fig. 125.



projecting over the table, and the patient fully under the influence of chloroform—the operator is ready to begin. Introducing the index finger, well oiled, into the rectum, to induce it to contract, and ascertain the position of the staff, and marking with his eye the situation of the tuberosity of the ischium, he stretches the integuments of the

perineum with the thumb and fingers of the left hand, and commences his incisions. The knife is entered just by the side of the raphé, on the left half of the perineum, an inch and a quarter above the margin of the anus, and is carried obliquely downwards and outwards, a short distance below the tuberosity of the ischium, and a little nearer to this point than to the anus (Fig. 125.) If the part is unusually full, the instrument is plunged in at the first stroke to the depth of at least one inch; otherwise it must be used more cautiously. As the knife descends, it is gradually withdrawn from its deep position, so as to give the wound a sloping appearance. The length of the incision must be regulated by the size of the perineum and the age of the patient; but, in the adult, it should not, in general, be less than three to three inches and a half. In the young subject it must be proportionately smaller.

Placing the point of the left index-finger in the upper angle of the wound, the knife is re-entered just by the side of it, and is made to divide, by repeated touches with its edge, the deep cellular substance of the perineum, the transverse muscle, and a portion of the triangular ligament, with a few of the fibres of the elevator muscle. The membranous portion of the urethra being thus exposed a little in front of the prostate gland, the surgeon feels for the groove of the staff, at the bottom of the wound, and having found it, he cuts into it through the denuded tube, the finger-nail serving as a guide to the point of the knife. The length of the opening in the urethra need not exceed the third of an inch.

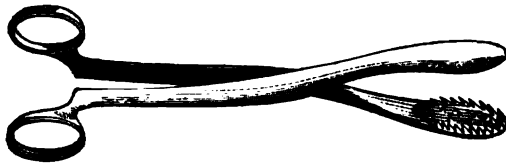
The knife, inserted into the groove of the staff, through the opening in the urethra, is now carried on into the bladder, dividing, as it passes along, the neck of the organ and the left lobe of the prostate, in a direction obliquely downwards and outwards, which is in that of its long axis. In executing this step of the operation, the rectum is to be held out of the way, by pressing it over towards the right side with the left index-finger, which should be steadily kept in the bottom of the wound, from the moment of the first incision. Great care should also be taken not to prolong the incision in the prostate gland too far back, for fear of penetrating the reflection of the pelvic fascia and the adjacent venous plexus.

As soon as the bladder has been opened, the urine escapes generally in a gush; the knife is now removed, and the finger, lying in the bottom of the wound, is placed in contact with the staff, which is immediately withdrawn. The urine, as it passes off, frequently forces the calculus down against the artificial opening, so as to

afford the surgeon an opportunity of ascertaining its form and bulk. When this does not happen, the finger is carried into the bladder to its full length, and used as a searcher. If the stone is found to be disproportionably large, the wound must be immediately dilated, either with the finger or the bistoury, according as the resistance may seem to depend upon the prostate or the muscular structures. In elderly subjects, the instrument will generally be necessary, as the gland is not sufficiently lacerable to yield to pressure.

The incisions being completed, the next step of the operation is to extract the calculus. This is to be done with the forceps (Fig. 126), which are conveyed into the bladder along the upper surface

Fig. 126.



of the index-finger, lying in the bottom of the wound in contact with the foreign body. The forceps are introduced with the blades closed, and are used at first as a searcher. As soon as they are brought in contact with the concretion, the blades are expanded over it, in the direction of its long axis, and with a firm grasp, to prevent the risk of slipping. Taking care that the instrument does not embrace any of the folds of the mucous membrane, the operator endeavors to extract the foreign substance by gently moving the forceps from side to side, or upwards and downwards, on the same principle as in the delivery of the child's head. The facility with which the stone may be seized depends upon circumstances. In general, it lies in contact with the inner extremity of the wound, and may be readily caught in the embrace of the blades of the instrument. Sometimes, however, as when it is lodged in the bas-fond of the organ, it refuses to come down, and may thus embarrass the young operator. The difficulty, as will be particularly mentioned hereafter, is easily remedied by inserting the finger into the rectum, and pushing the concretion forwards against the forceps. When the stone is situated in the superior fundus of the bladder, the forceps must be carried high up, in the direction of the long axis of the pelvis, where they are to be moved about as a searcher. Occasionally, it lies behind the pubic symphysis, and cannot be seized

until it has been dislodged by pressure upon the inferior part of the hypogastric region, aided by the finger in the bladder.

If the calculus is very small, it is sometimes more easily extracted with the scoop (Fig. 127) than with the forceps. The same instru-

Fig. 127.



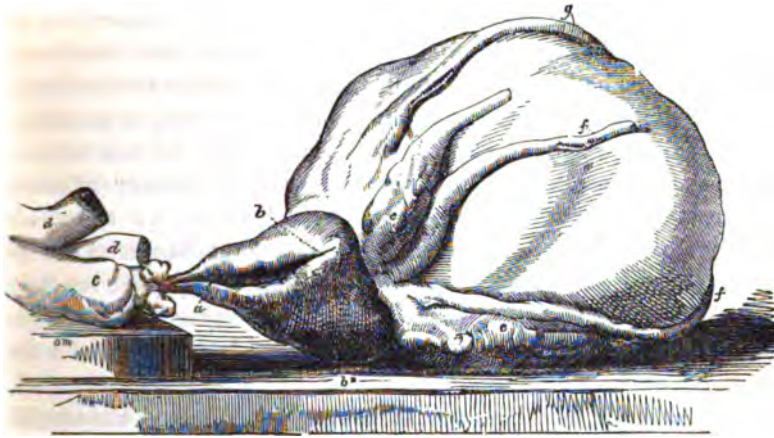
ment should also be used when the concretion has been broken, whether accidentally, or designedly, into fragments, which must then be removed piecemeal. The scoop is about ten inches in length, and is shaped, as its name indicates, at each extremity, like a spoon. An instrument like this may be made very serviceable in extracting an adherent, encysted, or impacted concretion.

As soon as the foreign body has been extracted, the bladder is washed out with tepid water, thrown up in a full stream from a large syringe. Any pieces, or fragments, that may have escaped the forceps or scoop are thus removed; otherwise there will almost certainly be a return of the calculous affection, the smallest particle frequently serving as a nucleus for a new concretion. The bladder having been washed out in the manner here mentioned, a female sound is next introduced through the wound into the interior of the viscus, and used as a searcher with a view of ascertaining whether any stones or fragments have been left behind. Should this be the case, the forceps, scoop, and syringe are again used till complete clearance is effected. In general, when the stone is rough, it is an evidence that it is solitary; but to this rule, there are, as will be seen by and by, exceptions, and of these the surgeon should be aware. The operation being finished, the patient is unbound, and conveyed to his bed, a piece of oil-cloth and a folded sheet being placed under his breech, to protect the clothing, and absorb the urine.

b. Extent of the Incision of the Prostate.—There is probably no subject connected with the lateral operation of lithotomy respecting which more diversity of opinion has been entertained than that which relates to the extent to which the incision in the prostate gland should be carried. This contrariety of opinion, however, exists in a much less degree now than it did formerly. Modern lithotomists seem to be pretty well agreed that the division should always be as limited as it can be consistently with the safe and easy extraction of the foreign body. In my own operations I have strictly adhered to

this rule, and have never had any occasion to regret it, but quite the reverse. The wound should in no instance, however bulky the stone may be, extend entirely through the lateral lobe of the prostate, on account of the danger of urinary infiltration, which seldom fails to be followed by the worst consequences, whatever may be the cause that gives rise to it. When the concretion is very voluminous, it

Fig. 128.



This engraving, copied from Scarpa, represents the left lobe of the prostate, as it is divided in the lateral operation. *a*. Marks the incision of the membranous portion of the urethra and the side of the gland. *b*. The left lobe of the prostate. *b°*. The right lobe of the organ. *c*. The bulb of the urethra. Close behind are observed Cowper's glands. *d, d*. The legs of the penis. *e, e*. The seminal vesicles. *f, f*. The deferent ducts. *g*. The ureter of the left side.

should either be broken, and extracted piecemeal, or, what is better, the opening should be enlarged by incising the opposite half of the gland, as recommended and practised by Liston and other lithotomists. If this do not afford sufficient room, the only resource is to crush the calculus, or to remove it by the supra-pubic section. In ordinary cases, where the foreign body is of moderate dimensions, I incise the gland to a very limited extent, and immediately after enlarge the opening with the finger, the pressure of which is generally sufficient for the purpose. Where it is not, the probe-pointed bistoury is used as a substitute. It is remarkable how lacerable the organ is in children and adolescents, and to what extent it may be torn, without endangering the parts by infiltration. In old subjects, especially such as have labored for a long time under induration and enlargement of the gland, the division is generally obliged to be effected with the bistoury.

From the influence which attention to this subject has a tendency to exert upon recovery after this operation, it is impossible to lay too much stress upon it. It is a subject, in fact, of paramount importance, and no operator does his duty who neglects it. Apart, too, from the consideration here stated, it is evident that the operation, if thus executed, will be less likely to be attended with injury to the rectum and the pudic artery.

Quite different is it with regard to the outer wound. While the internal should always be small, the external can scarcely be too large, or too free and dependent. The extent of the outer wound should never be less, in the adult, than three inches to three inches and a half; in very young subjects it must, of course, be proportionably limited, but even in them it should rarely be less than two inches and a quarter. There is no little risk of urinary infiltration where the external wound is small and elevated; for it serves to retain the water, as in a sort of reservoir, and enables it to fret and irritate the deep portions of the wound, before they have received a glazing of plastic matter. The rule, then, in regard to this subject is briefly and simply this, a small internal incision, and a free external one.

To Scarpa is due the merit of having first directed the attention of the profession to the importance of making, in all cases of this operation, a small section of the prostate gland. Until the publication of his celebrated *Memoir on Lithotomy*, operators were generally in the habit of dividing this organ very freely, or even in its whole extent. The consequence was that many of the patients thus treated, perished from infiltration of urine; an occurrence which is fortunately rarely witnessed at the present day, owing to the smaller size of the internal wound. The real *anatomical* cause of infiltration of urine, after this operation, was first explained by the late Dr. Granville Sharp Pattison, Professor of Anatomy in the University of New York. He ascertained, by careful dissections of the prostate gland and the neck of the bladder, that the danger does not arise from a division of the former organ, but from injury of the vesical reflection of the pelvic fascia, thereby allowing the fluid in question to insinuate itself into the surrounding cellular tissue, and even into the peritoneal cavity. This fact he zealously taught in his lectures nearly thirty-five years ago, and he subsequently published an account of his investigations in one of the early volumes of the *American Medical Recorder*.

c. *Extraction of the Stone*.—It has been already intimated that the

forceps should be used, during the extraction of the calculus, with great gentleness, that they should be moved about as carefully as possible, and that they should not, on any account, be permitted to grasp the bladder, or tear its lining membrane. Provided these precautions are duly observed, they may be introduced and withdrawn a great number of times without any serious detriment. In the case of Mount, previously alluded to, from whom I removed fifty-four concretions, the forceps and scoop were introduced at least thirty times, and yet old as he was, and long as he had suffered from vesical irritation, he experienced no particular inconvenience from this cause. In a case mentioned by Sir Astley Cooper, this distinguished surgeon introduced the forceps about seventy times, without any injury to the patient, who made a very good recovery.

The cruelties practised in former times in extracting stones from the bladder, are seldom perpetrated at the present day. It makes one's blood almost turn cold as he reads the records of this kind of misdeeds. Men, it would seem, actually prided themselves upon the amount of pain and suffering which they inflicted upon their victims, whose stifled groans sometimes only ceased with their last breath. We read of cases in which such violence was used, in the extraction of the stone, that the operator fell, exhausted, into the arms of his assistants; in which large portions of the prostate gland were wrenched away; in which the bladder was frightfully mangled and lacerated; in which one pair of forceps after another was bent, twisted, and broken; in fine, where everything was done to torture the poor patient, and bring discredit upon the operation. The results of such practice it is not difficult to guess. If the victim survive the immediate effects of the mal-treatment, he is sure to perish in a few days from peritonitis, inflammation of the neck of the bladder, or infiltration of urine.

The following case, mentioned by Mr. Fletcher, of England, in his *Medico-Chirurgical Notes and Illustrations*, published at London in 1831, shows the danger to which a patient may be subjected by long, painful, and repeated attempts at extracting urinary calculi. A healthy, middle-aged man, of unusual moral energy, and excellent spirits, underwent the lateral section with firmness and alacrity. Although the bladder was opened without difficulty by a free incision, the stone would not pass. After exerting himself to no purpose, the operator rested, and then recommenced his labors with redoubled vigor, placing his right foot against a chair, which was supported by a pupil. The straining and creaking of the forceps,

as he occasionally lifted the suffering wretch from the table, lasted nearly two hours. His efforts were at length successful, but the man was so much exhausted that he expired in a few minutes after being carried to bed. The calculus exceeded five ounces in weight. The body was not examined.

1. *Difficulties of Extraction.*—Difficulty frequently occurs in the extraction of the stone. This may depend, first, upon the stone itself; secondly, upon the bladder; and thirdly, upon the pelvis.

First, the difficulty may be caused by the lodgement of the stone in the bas-fond of the bladder, which is naturally the most dependent portion of the organ, and which, in old subjects, affected with enlargement of the prostate gland, is often converted into a sort of cul-de-sac. A concretion, especially when of inconsiderable volume, may be so deeply buried here as to elude every attempt, on the part of the surgeon, to seize it. The remedy is to raise the stone up, and place it within reach of the instrument, by the left index-finger inserted into the rectum.

The stone is sometimes lodged above the pubes, from which it may refuse to descend to the inferior part of the organ. When this is the case, an attempt should be made to displace it by compressing the hypogastrium, after thorough relaxation of the abdominal muscles. Should this fail, a strong probe, bent into a hook, may be used. Sometimes the stone may be drawn down with the point of the index-finger.

Secondly, the stone may be entangled in the folds of the mucous membrane; or it may be spasmodically grasped by the bladder, which may thus prevent the blades of the forceps from being expanded over it. In the former case, the scoop replaces the forceps, as being better calculated to disengage the foreign substance; or, if this fail, dislodgement may be attempted by throwing cold water into the bladder, in a full stream, from a large syringe. In the latter case, the surgeon desists for a few minutes, until the organ relaxes its convulsive grasp, when the foreign body is seized and extracted. Should the spasm be severe and refuse to yield, which, however, it will seldom do, it might be well to administer a full anodyne, and defer extraction until the part and system are brought thoroughly under the influence of the remedy. Such a step, however, will seldom, if ever, be required, as the employment of anæsthetic agents, now almost universal, will effectually prevent the occurrence in question.

Thirdly, it sometimes happens that the stone is encysted or

partly encysted, and partly free. When there is reason to believe that this state exists, it is advisable to introduce the finger into the bladder and to rupture the cyst with the nail; or, where this is impracticable, on account of its great strength and thickness, to divide it with a probe-pointed bistoury, or a knife fashioned like a gum-lancet, and furnished with a long handle. A similar procedure may be employed when the calculus has been rendered adherent by a mass of organized lymph; or when it is embedded in the wall of the bladder, impacted in the orifice of the ureter, or lodged in the body of the prostate gland.

Embarrassment may be occasioned by the presence of a pouch between the bladder and the rectum. Mr. Hancock, of London, some years ago, lithotomized a patient without encountering any difficulty until he introduced the forceps, when he was unable to discover the calculus. Death taking place soon after, the cause of the failure was found to be a large adventitious sac in the rectovesical septum, freely communicating with the bladder, and serving as a receptacle for the urine. The bladder itself was much contracted, and contained the calculus, which the instrument had thus been prevented from reaching.¹

Fourthly, it may be difficult to seize the stone on account of the great depth of the perineum, attended, perhaps, with an extraordinary length of the bladder. In 1843, I cut an old man in whom these obstacles existed in a most embarrassing degree. The perineum was at least three inches and a half in depth, and the bladder was so enormously elongated that, although it contained fifty-four calculi, a considerable time elapsed before I could reach them, notwithstanding my forceps, which were quite long, were buried up to their handle. The concretions were evidently lodged in the superior fundus of the organ, entirely beyond the reach of my finger, and almost beyond that of the instrument. Such an occurrence is rare in children, but not infrequent in old subjects. The remedy consists in making firm pressure upon the bladder just above the pubes, by which the stone is forced down into the lower part of the viscus.

Fifthly, the stone, under the grasp of the forceps, may break into numerous fragments, be reduced to a soft pulpy mass, or be crushed into small sandy particles. Sometimes, indeed, it is fractured spontaneously in the bladder before the patient is cut. The occurrence

¹ B. B. Cooper's Lectures on Surgery, p. 488. Philadelphia, 1852.

necessarily renders the operation tedious, if not actually more difficult, and there is always danger, however carefully it may be conducted, that some of the foreign substance will remain behind, and become the nucleus of a new formation. If the fragments are large, they may be extracted with the forceps; if small, with the scoop and syringe, with which the cavity of the bladder should be thoroughly washed out by throwing into it copious and repeated streams of tepid water.

The syringe which I prefer for washing out the bladder, is capable of holding twelve ounces, and is provided with a nozzle, four inches in length, slightly curved, to adapt it to the axis of the pelvis, and terminating in a small ivory ball, having four large eyelets, two at the sides, one in front, and one behind. This being introduced into the upper extremity of the organ, the fluid will be sure to come in contact with every portion of the mucous surface, and to carry away any pieces of stone, whether large or small, that may have eluded the scoop and forceps. In an operation performed by Dr. J. C. Nott, of Mobile, in which it appears to have been necessary to crush the calculus, a large gum-elastic catheter was passed into the bladder night and morning during the first few days, and the organ washed out by injections of tepid water as the patient was sitting over a chamber-pot.

Sixthly, delay and inconvenience may arise from the presence of a considerable number of calculi. It is a generally received opinion among surgeons, that when a stone, removed from the bladder, is rough on the surface, it is to be considered as a proof that there are no others. To this rule, however, many exceptions occur, as was shown, long ago, by Warner¹ and other practitioners. I have myself seen several examples of it, and all modern writers allude to the fact; which, as it is fully established, should put lithotomists upon their guard, and induce them never to neglect, on any occasion, the exploration of the bladder before the patient is untied and replaced in bed. As many as ten rough calculi have been removed from the same person at one operation.

When the stones are multiple, they should be extracted one after another, either with the forceps, or with the forceps and scoop. The repeated introduction of these instruments, if properly conducted, is rarely productive of much inconvenience; on the contrary, it is astonishing how well, in general, the operation is borne. It is only

¹ Cases in Surgery, p. 217. London, 1760.

when the bladder or the neighboring parts are severely irritated, bruised, or lacerated, that serious mischief is to be apprehended.

Seventhly, extraction may be rendered difficult by the fracture of the asperities of the calculus. Of this I had a remarkable instance in a gentleman of the name of Lentz, whom I cut some years ago. The stone was covered with long spines, a number of which broke off under the pressure of the forceps, which, in consequence, I was obliged to reintroduce at least six or eight times, before I was able to maintain my hold with sufficient force to effect extraction.

Eighthly, embarrassment and delay may proceed from the manner in which the stone is grasped. It is hardly necessary to state that the concretion should always, if possible, be seized by the forceps by its smallest diameter; but the reverse may happen, and then the extraction will, of course, be rendered proportionably difficult. When the surgeon has reason to believe that the calculus has been seized by its longest diameter, the finger should be at once introduced into the wound to ascertain the fact, and be prepared, if need be, to assist in changing the position of the foreign body. Before this can be done, however, the forceps must relax their hold upon the calculus, but it is not necessary to withdraw them from the bladder. For want of attention to this point, great injury is sometimes done to the neck of the bladder, as well as great delay experienced in removing the concretion.

Ninthly, embarrassment occasionally results from an inability to find the concretion after the bladder has been opened. This may depend upon some of the causes already detailed; or it may be owing to the expulsion of the stone, especially if it be of small volume, at the moment of completing the section of the neck of the bladder and the prostate gland. The urine, in such a case, may drive the calculus before it, which may thus escape without the knowledge of the operator, and be lost in the pool of blood and water, in the folds of the blanket or upon the floor. Such an accident might not only subject the patient to needless suffering, from long-continued and fruitless attempts to find the concretion, but also seriously compromise the character of the surgeon.

The following cases are in point: The elder Mr. Travers, of London, in 1824, lithotomized a very young child, at St. Thomas's Hospital, without being able, on the introduction of the forceps, to find a stone, although the previous symptoms and explorations had left no doubt in his mind that there was one. Soon after, however, one of the nurses of the establishment, in examining the wet sand at the

foot of the operating-table, discovered the missing substance—a small, brown, pea-shaped concretion—which had been forcibly expelled along with the fluid contents of the bladder.¹ A similar accident is said to have occurred to Professor Chelius, of Heidelberg. Having cut a patient, he was unable to find the stone, and had abandoned all hope of succeeding, when it was discovered in the jaws of the forceps used in the operation. On another occasion, an eminent surgeon found, to his dismay, that there was no calculus, although he felt positively assured beforehand of the presence of one. By chance, after much searching, in wiping a clot of blood from his coat, a small concretion, not bigger than a garden pea, was discovered in its interior.²

Tenthly. But the greatest embarrassment which the lithotomist has to encounter in the extraction of the stone arises from its bulk. It may be stated, as a general rule, that when the concretion weighs three or four ounces, it will pass the wound with considerable difficulty, and the impediment will be much augmented if it weighs six or eight ounces. It is true, a much larger calculus has sometimes been removed successfully; but, in most cases of this description, the patient has had a very narrow escape, and suffered a long time—perhaps permanently—from the injury sustained by the bladder, or the bladder and perineum, in the extraction of the foreign body. Cases illustrative of this fact will be hereafter mentioned.

When the calculus is of unusual magnitude, the extraction is to be accomplished either by simply enlarging the wound, if this has not been already done, to the utmost permissible limits, or by incising the right lobe of the prostate to the same extent as the left; or, finally, by breaking the concretion, and removing it piecemeal. Dilatation of the wound is effected with the probe-pointed bistoury, carried downwards and outwards in the direction of the original incisions, while the stone is held firmly with the forceps. The perineum being thus rendered protuberant, the resisting parts are put upon the stretch, and consequently yield more readily before the knife. The right lobe of the prostate is divided in the same manner, and in the same direction as the left. These two methods, it may now be observed, may almost always be resorted to with a reasonable prospect of success, when the weight of the stone does not

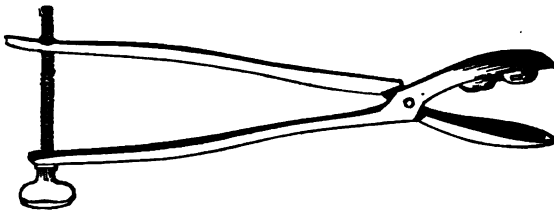
¹ *Observations in Surgery*, by Benjamin Travers, Jr.; *Dublin Quarterly Journ. of Med. and Surg.*, N. S., vol. xiv. p. 463.

² *Dublin Quarterly Journ. of Med. and Surg.*, N. S., vol. xiv. p. 464.

exceed three or four ounces. When the concretion is very bulky, crushing will generally be necessary. Sometimes, a combination of these expedients may be advantageously employed.

For breaking stones in the bladder, various instruments have been contrived, some of which are simple and convenient enough, while others are very clumsy and awkward. A goodly sized volume might be written upon this subject alone, and that too without exhausting it. The forceps represented in the annexed cut, Fig. 129, are well

Fig. 129.



calculated for this operation, and may be safely employed in all cases where such a procedure is likely to be required. Dr. Jamieson, a distinguished surgeon of Baltimore, recommended, many years ago, an instrument constructed upon the principles of the obstetric forceps, with a central drill. The blades, which are movable, and fenestrated at their vesical extremity, are closed by a slide, and are admirably adapted for grasping a large calculus. The forceps being applied in the usual manner, the drill is set in motion, and the foreign body broken into fragments, which are afterwards extracted piecemeal. When the concretion is soft, and not too bulky, it may be crushed and extracted, as has been done by Dr. J. C. Nott, of Mobile, with Heurteloup's lithotriptor.

Eleventhly. Embarrassment of a serious, if not an insurmountable character may arise from unusual narrowness of the outlet of the pelvis. In rickety subjects, the opening is sometimes reduced to a mere vertical slit. Some years ago, a soldier, affected with vesical calculus, died in one of the hospitals of Paris, and on examination it was found that the distance between the branches of the ischiatic and pubic bones did not exceed six lines.¹ In such a case, the perineal operation of lithotomy would, of course, be inadmissible.

Lastly. The calculus occasionally co-exists with calcareous incrustation of the surface of the bladder. Allusion has been already

¹ Robert, Journ. des Progrés, t. viii. p. 200.

made to this circumstance in a previous part of this volume. Such a complication will necessarily occasion delay, if not positive embarrassment in the operation. The proper procedure is, first, to extract the calculus in the usual manner, and then to remove the calcareous matter with the forceps, scoop, and finger, aided with the syringe. In a remarkable case of this kind, communicated to me by Dr. Amasa Trowbridge, of Watertown, New York, that gentleman gradually effected clearance in this manner, the wound being kept open for seventeen days, and the patient lying all the time on his back, with the limbs in a flexed and separated position. The substance was easily broken with the finger, and the quantity discharged amounted altogether to three ounces. The man, whose age was thirty-six, made a good recovery, and has ever since enjoyed excellent health.

2. *Extraction of Large Calculi.*—The subjoined observations respecting the extraction of large calculi, by different operators, with the results of their success, are condensed principally from a valuable and interesting paper on the subject, by Mr. H. Earle, in the eleventh volume of the *Medico-Chirurgical Transactions of London*. The facts which they disclose are of the highest practical importance.

Ambrose Paré¹ relates the case of a confectioner, cut in 1570 by John Collet, whose stone weighed nine ounces, and was three inches and a half in diameter. In an instance described by Tolet, a calculus weighing ten ounces, and measuring nearly four inches in diameter, was happily extracted, and the patient had recovered from the immediate effects of his wound, when an abscess formed in the kidney from the presence of a concretion, and terminated fatally on the ninth day from the operation. Gooch² relates a case in which Mr. Hamer, of Norwich, removed, by the lateral section, a stone of the weight of fifteen ounces, its diameter being four inches and three-quarters in one direction by three and a half in the other. The man, who was forty-eight years of age, survived, though the wound never entirely healed. Cheselden withdrew a concretion of twelve ounces, and succeeded in curing his patient. Klein³ successfully extracted a stone of thirteen ounces; it was somewhat conical in its form, and was nearly nine inches in circumference at its largest extremity, by three inches and three-quarters in length.

¹ Des Monstres, lib. xxv. ch. 15.

² Surgical Observations, p. 54.

³ Chir. Bemerkungen, Stuttgart, 1801.

The same eminent surgeon refers¹ to a case in which a concretion weighing twelve ounces and two drachms was successfully removed. In 1818, Charles Mayo, Esq.,² of Winchester, operated upon a man aged twenty-eight, and extracted a stone of fourteen ounces and two drachms, avoirdupois; it measured eight inches and a half in its smallest circumference by rather more than ten in the largest, and broke into several big pieces in the attempts to extract it. Mr. W. B. Dickinson,³ of England, successfully removed, from a man of sixty-two, a calculus of a globular shape, and composed chiefly of phosphate of lime, which weighed eleven ounces. It broke into several fragments, which were taken away piecemeal. The operation was followed by sloughing of the rectum, and when the case was reported, several months afterwards, a small fistulous opening still existed between this cavity and the bladder.

Although the above cases clearly show that a stone, even of large size, may occasionally be successfully extracted, yet it is equally certain that they must be regarded as so many exceptions to the rule, rather than as the rule itself. Most generally, indeed, the patient dies either from exhaustion during the operation, or from the effects of inflammation a short time afterwards. The following examples will place this subject in a more satisfactory light.

Fabricius Hildanus⁴ records a case operated on by Vitellius, in which the stone weighed twenty-two ounces; it was four and a half inches in length, and three inches and a half in width. The man, who was twenty-one years of age, died under the operation, which was very difficult, painful, and protracted. Geyer⁵ witnessed an operation on a boy in which the calculus was of the volume of a turkey's egg, and so adherent to the bladder that it had to be broken and extracted piecemeal. The fragments weighed ten ounces, and the patient died three days after the operation. Pallucci,⁶ La Motte,⁷ Vidal,⁸ and Eller,⁹ all mention examples of twelve ounces, which were extracted by operation, but in no one instance with a successful

¹ Mursinna's *Journal für die Chirurgie*, vol. iv. p. 94.

² *London Med.-Chirurg. Trans.* vol. xi. p. 54.

³ *Ibid.* p. 61.

⁴ *De Lithotomiâ Visica*, liber i. cap. 8, p. 720, et cent. 4, obser. 51.

⁵ *Miscell. Nat. Cur.* Dec. 11, an. v. obs. cxxx. p. 456.

⁶ *Nouvelles Remarques sur la Lithotomie*, p. 72.

⁷ *Chirurg. Observationes*, p. 820.

⁸ *Traité sur la Production des Pierres dans le Corps Humain*, p. 262.

⁹ *Histoire de l'Académie de Berlin*, 1757, p. 80.

result. Charles Preston¹ states that he saw at Paris a stone which weighed fifty-one ounces, which was taken from a religious brother in 1690, who died before the operation was concluded. A calculus of the weight of eighteen ounces is described by Borellus² as having been extracted by Quesnotus, but the patient did not survive. Marteau de Grandvilliers³ removed one of fourteen, and another of twelve ounces, with fatal results. Mr. Birch⁴ extracted a stone of sixteen ounces from a man in St. Thomas's Hospital, London. Deguise⁵ removed one of thirty-one ounces, from a patient aged sixty-five, by the high operation, having previously opened the bladder through the perineum. Death ensued on the sixth day. Sir Astley Cooper⁶ cut a man forty-three years of age, and found a stone which weighed sixteen ounces. The diameter in the long axis was four and a half inches; in the short axis, three and a quarter inches. It could not be broken, such was its firmness, and the wound in the perineum was, therefore, obliged to be extended as far back as the sacro-sciatic ligament. The patient survived the operation only four hours. In the case of a man forty-three years old, cut by Mr. Dalrymple,⁷ in the Norwich Hospital, in June, 1818, the weight of the calculus was upwards of twelve ounces, and death occurred at the expiration of about three hours. The stone could not be broken, and, after the lapse of about an hour, all hopes of extracting it were abandoned. Professor Graefe,⁸ of Berlin, removed from a man, aged thirty-eight, by the lateral section, a calculus which weighed twenty-one ounces and nearly four drachms. Its length was four inches and a quarter, its breadth three inches and three-quarters, and its thickness nearly three inches. Immense difficulty was experienced in effecting its extraction. The patient, who had suffered from his earliest infancy, was at first much relieved, but unfavorable symptoms soon appeared, and he died on the eleventh day. Dr. Mettauer, of Virginia, has in his possession a calculus of urate of ammonia, weighing upwards of sixteen ounces, which he removed

¹ *Philosoph. Trans. London*, vol. xix. p. 810.

² *Histor. et Observ. Med. Phys. Centur. li. obs. 22.* 12mo. Leip. 1676.

³ *Journal de Médecine*, t. xli. p. 54.

⁴ *Medico-Chirurg. Trans.* vol. xi. p. 76.

⁵ *Recueil Periodique*, t. vii. p. 423, et t. xiv. p. 424.

⁶ *London Medico-Chirurg. Trans.* vol. xi. p. 73.

⁷ *Op. cit.* vol. xi. p. 71.

⁸ *Anderson's Quarterly Journal*, July, 1824.

by the lateral section, the patient, whose age I have not been able to learn, making a good recovery.¹

It is fortunately rare, at the present day, that a lithotomist meets with a very large calculus. The operation has become so common that most of the cases, occurring in particular regions of country, are sure to be found out, and subjected to the knife at an early period after the appearance of the characteristic symptoms. It is only occasionally that an example of the kind is witnessed, and then only in old men, living in a state of isolation, away from surgical aid. I have heard of few examples of fifteen ounces, or over, in any part of the United States.

The following case illustrates some of the difficulties which sometimes occur in lithotomy, when the stone is of great size. I may mention that the operator was young and inexperienced, and that the calculus might possibly have been extracted through the perineum, without recourse to the supra-pubic incision. The case was doubtless well calculated to perplex an older surgeon; it was a first one, and may be compared, in its effects upon the mind, to a first case of labor, with a breech, arm, or shoulder presentation. The young gentleman, in announcing his troubles, writes: "I am in a 'bad box;' the worst kind of a 'bad box.' I have operated recently for stone through the perineum, and passed the scalpel into the bladder with little difficulty. The knife, on entering the viscus, struck against the calculus. I now introduced my finger, and touched the stone, which I found to be of enormous size, filling up the whole cavity of the bladder, which was firmly and spasmodically contracted upon the foreign body. Finding the incision in the neck of the bladder too small, I enlarged it to nearly two inches. I then introduced the forceps, but could not carry them into the bladder, much less expand them over the stone. I made many attempts to move the stone and change its position, but it was so large, and so exceedingly rough, that this could not be done. I now enlarged the wound in all directions to the greatest possible extent, and then renewed my efforts at extraction, but was again completely foiled. Whenever I touched the stone, it produced the most severe vesical spasm and bearing-down pains, similar to those of parturition. Finding all attempts to remove the stone of no avail, I was indeed greatly at a loss. The case was now just this. I had cut down to the stone, but found it impossible to extract it. The awful condition

¹ MS. letter to the author.

of the wretched man was before me with all its horrors. I would have given half my existence for a consultation."

In this quandary, the operator, rather than abandon his patient to his fate, proceeded to open the bladder above the pubes. Having reached the organ, he placed his finger upon it, and found it hard and firmly contracted upon the stone. An incision, upwards of two inches in length, was then made into it, when, introducing a finger, he succeeded, though not without difficulty, in raising the small end of the stone into the wound. "I now," says he, "seized it with the forceps, and attempted to extract it, but failed. I then tried to break it, but in this also I failed. Finally, I tried again with my finger, and after some difficulty succeeded in removing a calculus of a pyriform figure, weighing eight ounces, and measuring nine inches and a quarter in its greater, and seven inches and a half in its lesser circumference, by three inches and a half in diameter."

Notwithstanding two such large wounds, and the violence used in extracting the stone, the patient did remarkably well, and finally recovered. On the eighteenth day after the operation, he was able to walk about his room, and was gaining flesh and strength, both wounds healing kindly and even rapidly. The only inconvenience which he experienced was from a communication between the bladder and the rectum, caused by carrying the knife too far back in the attempt to enlarge the incision in the neck of the bladder. My correspondent closes his letter in the following expressive words: "Mr. W—— is a very stout, tough kind of a man; I do not believe that thunder and lightning could kill him." The experience thus bought has not been without benefit; instead of intimidating my friend, he has resolutely pursued his course, and has acquired no little reputation in his neighborhood as a lithotomist. The only error, perhaps, which he committed, was that he did not attempt to break the calculus, and extract it piecemeal. Such an attempt, however, might have proved fruitless, when we reflect upon the fact, previously adverted to, that he found it impossible, in consequence of the large size of the foreign body, to carry the forceps into the bladder, and to expand the blades over the calculus.

Many years ago, Dr. John D. Godman cut a patient at Cincinnati, for a stone which was found to be so large as not to admit of crushing or extraction. After numerous attempts to free the bladder, the case was abandoned as hopeless. The wound healed up, and the man subsequently walked to Carlisle, Pennsylvania, a distance of nearly seven hundred miles. Here he was operated upon a

second time, with a like result, by Dr. Given. After recovering, he proceeded to Philadelphia, where he was finally relieved by Dr. Gibson and Dr. Physick. The bladder being opened, the stone was found almost to fill the organ, and was, therefore, obliged to be broken before it could be extracted. The patient recovered in a fortnight, and again walked home, as Dr. Chapman facetiously remarked, "a stone lighter than when he came."¹

It is said that Marjolin once met with an instance in which the stone was so large that it was necessary, before extraction could be effected, to saw through the bones of the pubes. McGill, an English surgeon of the last century, once performed the high operation, without being able to remove the stone. The patient died on the fourteenth day, when the attempt to extract the calculus was renewed, the straight muscles being previously cut away at their inferior attachments. This method also failing, he sawed off one of the pubic bones, and then succeeded.

d. Accidents during and after the Operation. 1. *Hemorrhage.*—One of the most serious accidents attending perineal lithotomy is hemorrhage. This, which may be either arterial or venous, may take place at the time of the operation, before the completion, perhaps, of the incisions, or after the incisions have been made, but before the stone is extracted; or it may not happen until after the foreign body has been removed, and the patient put to bed; in fact, not until after the expiration of several hours or even days. In the former case, the hemorrhage is said to be primitive; in the latter, secondary. The quantity of blood lost may be small, or so copious, as to induce severe and even fatal exhaustion.

It is impossible, in the present state of the science, to form any accurate idea of the mortality from hemorrhage, or even the frequency of its occurrence, after perineal lithotomy. Various estimates have been made by different writers, but the data upon which they are based are too imperfect to justify us in placing any reliance upon them. Mons. L. J. Bégin, of the Val-de-Grace Hospital of Paris, thinks that one out of every twenty or twenty-four who submit to the lateral operation perishes from the loss of blood; while the mortality from the bilateral method, as practised by Dupuytren and other surgeons, is only one in forty-two. My own conviction is that this estimate is much too high. It is seldom, indeed, that we hear of a patient dying from the loss of blood from the common

¹ Cooper's Surg. Dictionary, by Reese, Appendix.

operation, especially when it is executed with the knife. The most distinguished lithotomists hardly allude to the subject, and writers on surgery are almost equally silent. Rau, Tolet, Colot, Cheselden, Deschamps, Klein, and Desault, rarely lost a patient from this cause. The most celebrated modern operators, as Martineau, Roux, Crichton, Liston, Crosse, Langenbeck, and Dudley, appear to have not been less fortunate in this respect. In operating with the gorget, the danger of hemorrhage is probably greater than in operating with the knife, especially with the young and inexperienced surgeon. An unusually wide gorget must always endanger the pudic artery, and the same is true of the knife when the incision is made too far out towards the ischium. The artery of the bulb is rarely divided, except when the incision is extended too high up; and the hemorrhoidal artery is usually avoided by taking care not to carry the instrument too deeply into the ischio-rectal fossa. In short, when proper caution is observed in performing the operation; when the pelvis is of the ordinary width; and when the vessels of the perineum are perfectly regular, both as it respects their distribution and volume, little danger, I presume, is to be apprehended from hemorrhage.¹

Under ordinary circumstances, the loss of blood *need* not exceed four or five ounces. In many of my operations it has not, I am sure, equalled half that quantity. A moderate flow of blood, especially in young, plethoric subjects, is rather desirable than otherwise, since it is a great security against subsequent vascular excitement. Where the patient is thin and feeble, too much care cannot be observed in regard to the loss of blood; the smallest quantity, in such a case, may prove serious.

The principal sources of the hemorrhage in this operation are the artery of the bulb and the superficial artery of the perineum. In old subjects, a copious flow of blood occasionally proceeds from the veins of the neck of the bladder and the prostate gland. The pudic artery, in its normal course, can hardly be wounded posteriorly, from the manner in which it is protected by the ramus of the ischium; as

¹ Dupuytren, many years before his death, in order to avoid the danger of hemorrhage, invented a new operation. He cut the bladder above the prostate gland, on the supposition, doubtless, that the division of this organ and the parts immediately around it was the chief source of bleeding. The plan, however, was soon abandoned; since, out of the seven patients thus treated, five died from the lodgement of the urine between the bladder and the pubes.—John Shaw, in *Quarterly Journal of Foreign Med. and Surgery*, January, 1821, p. 45.

it extends forwards, however, into the anterior part of the perineum, it becomes more exposed, especially where it lies between the layers of the triangular ligament, and is, therefore, in danger of being injured. This accident, which has occurred to Physick, Charles Bell, Everard Home, Crosse, and many other distinguished operators, is most liable to happen when the prostate is divided with the gorget, the lithotôme caché, or the beaked-knife. When the pudic artery arises directly from the internal iliac, and passes forwards over the side of the prostate, on its way towards the penis, it is hardly possible for it to escape, no matter how the operation is performed. An anomaly of this kind was the cause of a fatal hemorrhage in the celebrated case of Mr. Shaw, of London.

The artery of the bulb is one of the largest branches of the pudic, and is apt, when divided, to bleed profusely. From its deep position, and the readiness with which it retracts, it is always secured with difficulty. The late Mr. Key, of London, was of opinion that this vessel is almost always divided in the lateral operation; a view in which I am not disposed to concur, for the reason that, if this were the case, the mortality from this operation would be much greater than it is. It is best avoided by making the incision low in the perineum; but, when this is done, there is danger of cutting into the groove of the staff through the prostate gland instead of the membranous portion of the urethra; a circumstance which would lead to much difficulty in extracting the stone. When the artery arises lower down than natural, its division is almost inevitable. In a case of fatal hemorrhage, which occurred to Mr. Kerr, of Aberdeen,¹ on the fifth day after the operation, the bulbar and transverse arteries came off by a common trunk, which soon separated into two branches, of which the one that corresponded with the former vessel ran much further back than usual, so as to be in the line of the incision, and was, of course, divided along with the latter.

A tremendous gush of blood sometimes proceeds from the transverse perineal artery, which is occasionally enormously enlarged, even in very young subjects, probably in consequence of the long-continued irritation kept up by the stone in the bladder. The bleeding, in this case, generally follows the first incision, and should be immediately arrested by the ligature. In one of my patients, a young man about twenty-one years of age, the blood flowed from the divided vessel with a loud hissing noise and in a full stream, to

¹ *Banking's Half-Yearly Abstract*, July to December, 1847, p. 208.

the amount of three or four ounces, before my assistant succeeded in tying it.

The superficial perineal artery is rarely cut; when it is, the bleeding is generally so trifling as not to require any particular notice on the part of the operator. It is only when the vessel is uncommonly large, or when it retracts within the opening of the fascia through which it emerges, that it is likely to become a source of trouble. In either case, the hemorrhage may be so profuse as to induce the belief that it proceeds from a wound of the pudic artery.

The inferior hemorrhoidal artery, the posterior branch of the pudic, is generally of small size, and is in no danger of being injured, except when it is given off unusually high up, and passes almost across the ischio-rectal space without dividing. Should such an anomaly exist, the hemorrhage might be quite free, though it would be easily enough arrested, unless the vessel is cut so close to its origin as to retract within the surrounding tissues, or its coats are so diseased as to be incapable of supporting a ligature.

A considerable hemorrhage occasionally proceeds from the vesical veins, or the arteries and veins of the prostate gland. In old persons, especially in such as have labored long under stone in the bladder, stricture of the urethra, perineal fistule, irritation of the rectum, or disease of the prostate, these vessels are exceedingly prone to varicose enlargement, forming a close plexus, which is habitually distended with black blood. The cellulo-fibrous tissue in which this plexus is imbedded, is, under such circumstances, also much changed in its character, being not only increased in quantity, but likewise considerably indurated. Hence, when these vessels are divided they are unable to retract, or bury themselves among the surrounding parts, and the hemorrhage, which is often very profuse, the blood welling out simultaneously from a great number of points, can only be arrested by protracted compression, aided by cold applications.

On the whole, it is exceedingly probable that, in very many cases, if not in a majority, in which the hemorrhage is at all copious, it proceeds from an anomalous arrangement of the perineal arteries. Boyer, who was a believer in the frequent occurrence of this accident after the lateral operation, makes the following just remarks: "The blame of the hemorrhage is often thrown upon the operator, or on the method which he may have selected; but in most cases improperly; for the perineal arteries present such a multitude of varieties, both in their situation and course, that the most skilful

surgeon cannot be certain of avoiding them, no matter what procedure he may adopt."

Much difficulty is often experienced in ascertaining whence the blood proceeds. When the transverse perineal artery is divided, its source is usually sufficiently obvious, from the superficial situation of the vessel; but when the pudic artery, or the artery of the bulb, is cut, it is no easy matter frequently to decide this important question. Nothing, in such a case, short of the most thorough examination can enable us to detect the bleeding orifice. This examination should be conducted with the fingers, assisted by a sponge mop, and a small pair of lithotomy forceps, for separating the deep portion of the wound. It has occurred to me that a small wire speculum might be made available to such an exploration, and I have accordingly requested Mr. Tiemann, my cutler, to add such an instrument to my case. A stream of tepid water, directed upon the wound, from a syringe, would be of service in washing off the blood, and pointing out the spot whence it issues.

The seat of the hemorrhage will often enable us to determine its source. Thus, when it proceeds from the artery of the bulb, the blood issues from the upper angle of the wound; from the lower angle, when it is furnished by the hemorrhoidal; and from the external part of the wound, when it comes from the pudic, or superficial perineal. When the hemorrhage is seated very deeply, the probability is that it proceeds from the vesical plexus, from some of the vessels of the prostate gland, or from an irregular distribution of the pudic, as in the case, already adverted to, of the late Mr. Shaw.

When the hemorrhage arises from the injury, division, or laceration of a fungous tumor of the bladder, its source will usually be sufficiently indicated by the difficulty or peculiarity attending the operation, and by the absence of hemorrhage from the perineal vessels.

Serious, if not fatal bleeding may arise from another cause, entirely unavoidable in its character. A man, for example, may be laboring under what is denominated the *hemorrhagic diathesis*, so that he cannot meet with the slightest wound without having his life endangered by the loss of blood. This peculiarity, which often occurs in several members of the same family, is more common in the male than in the female, and is occasionally hereditary in its nature, being transmitted from one generation to another. The blood, in this variety of hemorrhage, generally proceeds from numerous points, oozing from the divided parts as from the pores of a

sponge. Now, should a patient, affected with this diathesis, be cut for stone, he would probably bleed to death; for no care which the surgeon could employ after the operation would be likely to save him. It should, therefore, always be the duty of every one to inquire into this circumstance before he ventures upon the use of the knife.

Sir B. C. Brodie¹ refers to a very interesting case in which the patient lost his life from this cause. The man, who belonged to a family which had this singular disposition to hemorrhage, had symptoms of stone in the bladder, attended with large discharges of blood from the urethra. A surgeon, whom he had consulted previously, supposed him to be laboring under fungus hæmatodes. Upon sounding him, Sir Benjamin readily detected a calculus, and proposed the operation of lithotomy; but to this the patient objected, saying that he should bleed to death. A circumstance occurred soon afterwards which confirmed his opinion, and led to an abandonment of the operation. He had been cupped in the perineum, and the wounds made by the scarification had bled every other day for nearly three weeks. Some time after this the man fell into the hands of another surgeon, who, regardless of what had happened, and rather inclined to laugh at the idea, performed the operation; frightful hemorrhage ensued, and terminated fatally in twenty-four hours.

However the hemorrhage may be induced, or from whatever source it may originate, it is to be borne in mind that the blood may escape only partially, or perhaps not at all, at the wound, but that it passes inwards into the bladder, where it is either retained, or expelled from time to time in thick clots. The organ, under these circumstances, will form a hard, solid tumor, which is more or less tender on pressure, and which may mount as high as the umbilicus. The expulsion of the clots, or rather the efforts made by the bladder to rid itself of its contents, are attended with violent suffering, and bear a close resemblance to labor-pains.

The means for arresting the hemorrhage are: 1. The ligature; 2. Torsion; 3. Compression; 4. Cauterization and styptics; 5. Cold applications.

1. In all cases where the artery is within reach, the ligature should be employed in preference to any other expedient. The reasons for this are obvious, and need not be here discussed. The vessel should be seized with the forceps, tenaculum, or needle, and

¹ Clinical Lectures on Surgery, p. 86. Philadelphia, 1846.

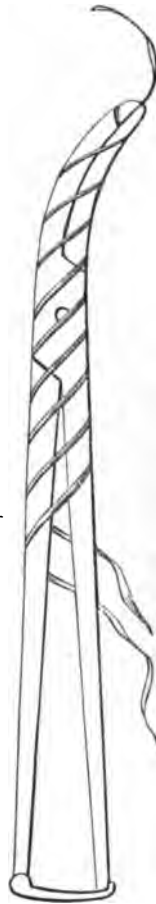
secured in the usual manner, one of the ends of the ligature being left hanging out of the wound, for fear of its escaping into the bladder, and thereby laying the foundation of a future calculus. When the artery of the bulb is cut, it may be drawn forwards by means of a pair of very slender polypus-forceps, which answer the purpose much better than the common instrument, or the tenaculum, which permits the blood to escape by its sides, so as to obscure the bleeding orifice, and interfere with the application of the ligature. The pudic artery, owing to its deep situation, is best secured with Physick's forceps, represented in the annexed drawing (Fig. 130). It is an admirable instrument, and should find a place in every lithotomy case. It is far superior to Deschamps' needle, and the clumsy contrivance of Verdier. It is not necessary, at the present day, to consider the proposal of the latter writer, to surround the pudic artery and the ramus of the ischium with a ligature carried across the thyroid foramen. Such a suggestion is not to be seriously entertained.

2. Torsion, as a means of arresting hemorrhage of the perineum, is to be thought of only when a small artery is divided, or when the vessel from which the blood proceeds is situated so deeply as to render it difficult to tie it. It is here, as elsewhere, under ordinary circumstances, far inferior to the ligature.

3. Compression, which may be resorted to in all cases where it is impossible to use the ligature or torsion, may be made with the finger, a tampon, a canula, or a pair of forceps. The former of these methods was much employed by Pouteau, who sometimes maintained the pressure for hours together, by a relay of assistants. The practice might be useful in some cases, as when the other means fail, but it is too inconvenient and fatiguing, both to the patient and the surgeon, to be resorted to on slight occasions.

A more eligible mode of making compression is by means of a canula, surrounded by charpie, sponge, or cotton. The canula may consist of a piece of silver, or gum-elastic, three inches and a half

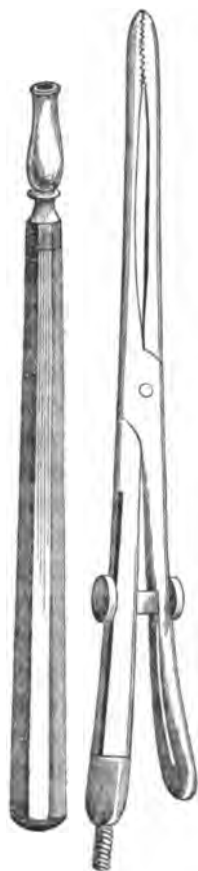
Fig. 130.



long, by four lines in diameter, and provided at the perineal extremity with two holes or rings for securing it, by means of threads or ribbons, to a T bandage. The instrument is introduced into the bladder, and firmly surrounded by charpie, or some other substance, for the twofold purpose of conducting off the urine, and compressing the bleeding vessel. It should be retained in its place for four or five days, or until there is reason to believe that all danger of hemorrhage is over. When no canula is at hand, and the case is urgent, a female catheter, a piece of reed, or the spout of a tin coffee-pot, may be used as a substitute.

The compression may be effected, in the third place, with a common tent, or a tampon of sponge, charpie, or soft linen; but, in this case, it is necessary to keep a catheter in the urethra for carrying off the urine. This mode of compression is particularly applicable to deep-seated hemorrhage, or to cases where the blood proceeds from the vesical veins, or the arteries and veins of the prostate. This kind of hemorrhage, as has been already seen, is most common in aged calculous patients, and can hardly be arrested in any other manner. In this variety of compression, as well as in the preceding, the deep portion of the wound must be plugged first, dossil being piled upon dossil until the whole is filled up. A soft compress is then applied to the perineum, and the whole confined by a T bandage.

Fig. 131.



Lastly, in obstinate cases, where neither the ligature, torsion, nor the more ordinary modes of compression are available, the hemorrhage may be arrested by pressure made with a pair of very slender, delicate forceps, provided with moderately sharp teeth, and a slide for closing the handles. Such an instrument, which need not be more than three and a half inches in length, and the weight of which need not exceed two drachms and a half, is represented in the annexed sketch (Fig. 131). It will be observed that it terminates behind in a screw, to adapt it to a movable handle, which is necessary to facilitate its application. The forceps should

be made of silver, to prevent oxidation; and they may be retained in the wound until all danger of hemorrhage is over. In an operation for stone, which I performed upon an elderly gentleman a few years ago, I employed, with great advantage, the ordinary sliding forceps; the bleeding proceeded from an artery of considerable size, apparently the accessory pudic, which, in consequence of its great depth, it was impossible to secure by ligature. The blood gushed out in a full stream, and was promptly arrested in this way, the instrument being retained several days in the wound, which, notwithstanding, healed in the usual time. A *compressing forceps*, such as those here delineated, on rather too large a scale, might afford very efficient service in operations about the neck and clavicle, where it is occasionally so difficult to arrest the flow of blood by the ligature.

Although I have spoken here of compression, and pointed out the manner in which it may be made, and the circumstances in which it is applicable, I must confess I have no partiality for it. On the contrary, I should always resort to it with reluctance, inasmuch as it is not only attended with more or less pain, but is liable to lead to undue inflammation both of the perineum and the bladder, and may even be productive of serious consequences. There are cases, however, in which it is unavoidable, and in which no judicious practitioner would hesitate to employ it.

In a case in which I had occasion, three years ago, to employ compression on account of a hemorrhage which threatened to become serious, and in which the blood issued from a large number of points, the wound did not entirely close for nearly three months. The patient did well in every other respect, and no cause, except the one here mentioned, could be assigned for this untoward occurrence. The compression was effected by means of a piece of sponge, which was retained for four days, when every particle of it was removed.

Mr. Travers, of London, in a case of troublesome hemorrhage from the artery of the bulb, which resisted the ordinary means, finally succeeded by putting a hard compress of cork under his patient, in such a situation that the weight of the body compressed the internal pudic artery between the foreign substance and the spinous process of the ischium. "The precise point at which the compress should be placed may be ascertained by drawing a line from the upper part of the trochanter major to the articulation of the os coccygis with the sacrum. At the junction of the inner with the middle third of this line is situated the spinous process of

the ischium; the internal pudic artery passes immediately over it. The necessity for placing the patient, under these circumstances, upon a hard mattress, is sufficiently obvious."¹ In a very lean subject adequate pressure might be applied here by means of the thumb and fingers. The method of the English surgeon is both novel and ingenious, and should not be overlooked in obstinate and deep-seated bleeding, uncontrollable by ligature and other means.

4. I can hardly imagine a case of hemorrhage, consequent upon the operation of lithotomy, in which it would be proper to use the actual cautery, or what are called styptics. All such measures must be fraught with danger, and can be justifiable only as a dernier resort. High inflammation, if not sloughing, would be almost certain to follow their employment.

5. Cold applications, in the form of irrigations, may be used, in many cases, with benefit. Made directly to the wound, or the perineum, they have a tendency to promote the contraction of the bleeding vessels, to allay pain, and prevent inflammatory action. The water, which must not be too cold, should be directed upon the part, in a continuous but gentle stream, from a patent syringe, and the pelvis should be so situated as to enable it to run into a tub at the side of the bed. A piece of oil-cloth, placed under the nates, will more effectually secure this object. The operation may, if necessary, be kept up several hours without risk of injury. Mons. L. J. Bégin, who has written a paper on this subject in the *Mémoires de l'Académie Royale de Médecine*,² asserts that he has employed this method with the most complete success in two patients, although they were reduced to an almost hopeless state prior to its institution. It may be aided by cold applications to the hypogastric region, groins, and inside of the thighs; by strict recumbency; by cooling, acidulated drinks; and by full doses of opium, which should never be omitted, as they constitute an important part in the treatment of all traumatic hemorrhages. When the bleeding depends upon the peculiar diathesis, previously described, our chief reliance must be upon opium and acetate of lead, opium and alum, or opium and gallic acid, with ice and some one of these salts to the wounded parts.

The period, after the operation, at which *secondary hemorrhage* sets in, varies from a few minutes to several hours or days. If it

¹ B. B. Cooper's *Lectures on the Principles and Practice of Surgery*, p. 481. Philadelphia, 1852.

² T. x. p. 120. Paris, 1848.

does not come on within the first ten or twelve hours, the probability will be strong that it will not show itself at all. In general, it will make its appearance as soon as reaction is established, or the patient has recovered from the shock of the operation. An artery that may have ceased to bleed, in consequence of the enfeebled state of the heart, may now furnish an abundant jet, alarming the bystanders, and rapidly exhausting the patient. Such a case admits of no delay. Prompt and vigorous action is required, or all will be lost. Hesitation would be fatal. The means already pointed out must be put in force; the coagulated blood must be removed with the fingers, scoop, or syringe; the bleeding vessel must be exposed and tied; or, if the ligature is inadmissible, compression or irrigation must be resorted to, and steadily maintained until all danger is past.

The older lithotomists speak of secondary hemorrhage taking place several days and even weeks after the operation. When it is recollected what violence they employed in extracting the stone, we need not be surprised at the occurrence, which is fortunately extremely rare in the present improved mode of proceeding.

2. *Sinking*.—Few patients, at the present day, perish from the shock of the operation of lithotomy. Indeed, great depression, or death can hardly occur in the hands of a skilful surgeon, unless the patient is laboring under some idiosyncrasy, under disease of the heart or large vessels, or under excessive debility from previous suffering. It is, however, easy to conceive that very alarming, if not fatal, results may ensue when the operation is unusually protracted, when great violence is used in extracting the stone, accompanied with severe contusion or laceration of the bladder and perineum, or when there has been a considerable loss of blood. Under such circumstances, the shock may be so great that the patient may die upon the table, soon after he is put to bed, or, at all events, during the first twenty-four hours, without, perhaps, any attempt at reaction. In former times, death was occasionally produced by excessive pain, operating upon a nervous and debilitated constitution; but since the introduction of chloroform and other anæsthetic agents, no such accident has occurred. When a patient is laboring under "shock," the circumstance is denoted by the excessive pallor of the countenance, by the small, rapid, fluttering, and indistinct pulse, the coldness of the extremities, the disturbed breathing, the rolled-up eyeball, the intense thirst and constant restlessness, the incoherent state of the mind, and the deadly prostration of the system.

The treatment must be stimulating. The head is laid low, to favor the action of the heart and the return of the blood to the brain; a free access of air is provided; a smelling-bottle is held to the nose; and the patient, if he can swallow, must take large quantities of brandy, either alone or in union with ammonia. These remedies are aided, if necessary, by the application of heat, friction, and sinapisms. When the danger is imminent, mustard should be applied to the spine as well as to the præcordial region, and recourse should be had to injections of spirits of turpentine, alcohol, or ammonia. When reaction begins, the patient must be carefully watched, lest over-stimulation take place, followed by excessive nervous and sanguineous excitement.

3. *Retention of Urine.*—This accident is indicated by a total cessation of the flow of urine, by sharp, burning, or scalding pains in the lower part of the pelvis, attended with tenesmus and a constant desire to pass water, and by a gradual distension of the bladder, which can be felt as a firm, tender, and ovoidal tumor in the hypogastric region. It may be caused by inordinate tumefaction of the wound and spasm of the urethra; or, as more frequently happens, by the closure of the two passages by coagulated blood. In the former case, relief is afforded by the catheter; in the latter, by clearing away the blood with the finger or scoop, and inserting, if necessary on account of the persistence of the hemorrhage, a canula, for the twofold object of compressing the bleeding vessels and conducting off the urine.

4. *Undue Inflammation of the Wound.*—The wound made in the operation of lithotomy may take on undue inflammation, in consequence of the injury done to the soft parts in extracting the stone, slight urinous infiltration, or some defect of the constitution. It usually supervenes within the first forty-eight hours. The action is sometimes erysipelatous, and is then apt to spread from the wound to the nates and the thighs, as well as to the groin and the abdomen. Unless the disease, in whatever form it presents itself, is promptly arrested, copious suppuration may ensue, lasting, it may be, for a number of days, and seriously jeoparding the patient, perhaps already much exhausted by previous suffering. The inflammation sometimes runs into gangrene, producing a dark, foul appearance of the wound, and involving, as it extends, the neck of the bladder, the cellular tissue between this organ and the rectum, and even the rectum itself. This accident happened to me in a patient on whom I operated in the winter of 1844, and to whose case I have already

several times alluded. He was twenty-six years of age, of a delicate constitution, and had been affected with the disease from his infancy. I cut him on a Friday, extracting a rough, heavy calculus, about the size of a hen's egg. He bore the operation, which was performed in good time, exceedingly well, and nothing untoward occurred until the following Monday, when the wound, without much previous swelling, began to assume an unhealthy erysipelatous aspect. The next day it looked still worse, and the man was seized with a thin, watery diarrhoea, having, in rapid succession, not less than eleven motions. Late in the afternoon, fecal matter was seen issuing through the wound, and this continued for several weeks, the quantity gradually diminishing, and the wound steadily contracting. The cicatrization was completed in less than a month; but when the man left town, a little urine still flowed by the rectum. I have since learned that he speedily recovered after he reached home.

5. A peculiar form of inflammation of the wound, named *phlebitis*, occasionally occurs after this operation. It is most frequently met with in elderly subjects, affected with an unusual development of the veins of the neck of the bladder and the prostate gland. The disease usually arises within the first four or five days, and soon spreads through the neighboring cellular tissue, assuming a diffused erysipelatous character, and terminating, if the patient survive sufficiently long, in purulent infiltration. The French surgeons consider *phlebitis* as a very common cause of death after this operation; a view which has not, I believe, been confirmed by English and American observers.

The treatment is antiphlogistic, conducted cautiously, and with due regard to the constitution. Cold or warm applications are used as may be most grateful to the part and the system; iodine is applied to the surface around the wound, especially in the erysipelatous form of the inflammation, and the utmost attention is paid to cleanliness. If gangrene supervene, the wound must be syringed with weak solutions of nitric acid, tincture of myrrh, or the fluid chloride of soda, for the purpose both of correcting fetor, and instituting a more healthful action. The constitutional treatment must be directed upon general principles.

The *phlebitis*, consequent upon this operation, occasionally invades the extremities, producing symptoms very similar to those which accompany *phlegmasia dolens*. I am not able to state when this occurrence first attracted the notice of the profession; but a

well-marked example of it was observed in 1823, by Dr. A. H. Stevens,¹ of New York, in a man, aged twenty-four years, who, three hours after the removal of a very moderate-sized stone, was seized with severe and annoying hemorrhage, which continued to recur, at intervals, until the end of the seventh day. The left leg afterwards enlarged, as in phlegmasia dolens, and at length became the seat of an enormous abscess, from which three pints of matter were discharged. The patient gradually recovered.

Another example of this disease was observed in 1838, by Mr. Greenhow, of England; and, in 1850, two cases were published in the *London Lancet*, one by Mr. Bransby Cooper, and the other by Professor Pirrie, of Aberdeen.

In two of the cases observed by the British surgeons, the disease began in the calf of the leg, and in the other in the thigh. The disease, which was preceded and accompanied by rigors, caused severe pain and swelling, especially along the course of the internal saphenous vein; and supervened at the end of the thirteenth, sixteenth, and twenty-third day after the operation. In Mr. Cooper's case, which terminated fatally three days after the attack, the urine became infiltrated into the perineum on the fourth day after the removal of the calculus, and produced some sloughing of the scrotum; it is worthy of remark that phlebitis was beginning to reign epidemically at Guy's Hospital when the operation was performed, and that the disease ultimately extended to other parts of the body, as the opposite leg, the wrists, and the elbows. In Mr. Pirrie's patient, a fat, healthy-looking man, sixty-nine years of age, the wound was unaffected throughout, though the limb was enormously swollen and exceedingly tense. The disease, however, remained confined to the extremity originally involved, and gradually yielded to suitable remedies. In the case observed by Mr. Greenhow, some time elapsed before the urine passed freely by the wound, the final closure of which was retarded by the affection of the leg. The patient, a youth, aged nineteen, although much reduced, finally recovered; but the limb remained large, stiff, and slightly painful for some weeks, following very much the course of a case of genuine phlegmasia dolens.

Professor Fergusson,² of London, mentions a case in which he lost his patient two months after the operation, and after complete closure

¹ Lectures on Lithotomy, p. 22, 1838.

² *London Lancet*, Sept. 19, 1846.

of the perineal wound, in consequence of the formation of a large pelvic abscess. The patient was an old man, aged seventy-four years, and it was conjectured that the mischief had been induced simply by unhealthy inflammation, caused by the contact of the urine. Mr. Fergusson thinks that if the patient had been younger the inflammation would have been of a more adhesive character, and there would have been no such ravages.

In the spring of 1853, I lost a boy, aged eight years, twenty-four days after the lateral operation, from phlebitic abscesses in the left kidney. The organ was very much hypertrophied, and the cortical substance contained at least fifty abscesses, varying in size from the head of a small pin to that of an ordinary pea, of a whitish aspect, and filled with yellowish semi-concrete matter. The right kidney was unnaturally small, and exhibited various evidences of chronic, but none of acute disease. The coats of the bladder were considerably thickened, but otherwise sound, as was also the prostate gland. The perineal wound was entirely closed, except at the inferior angle, where there was an opening not larger than a goose-quill.

In the above case, everything went on in the most favorable manner, until the end of the fifth day, when the patient was seized with rigors, and other symptoms portending mischief. The accompanying fever was exceedingly obstinate; there was an entire absence throughout of appetite, and the emaciation was most rapid. During the first fortnight, there was frequent vomiting, with great thirst and jactitation, which continued afterwards in a diminished degree, until within a few days of the boy's dissolution.

In a case which recently occurred in one of the London hospitals, a man, aged thirty-one, died seven days after the operation, in consequence of abscesses in both kidneys, and a large collection of matter in the left knee-joint. He had also crude tubercles in the right lung. The stone weighed one ounce and a half. All the symptoms of pyæmia were present.

When the phlebitis attacks the extremities, the proper local remedies will be leeches, fomentations, iodine, and blisters, followed by free incisions to afford vent to effused and pent-up fluids. The system must be supported by anodynes and stimulants, especially opium, quinine, and brandy, administered in full and sustained doses; venesection is generally inadmissible, if not decidedly prejudicial, and the use of mercury, except in so far as it tends to correct the secretions, may commonly be dispensed with. After the

violence of the inflammation has subsided, the limb should be carefully bandaged, and as soon as the patient is able to move about, he should take gentle exercise in the open air.

6. *Lesion of the Prostate Gland.*—This gland may be seriously injured in this operation, either by the knife, the finger, the forceps, or the calculus. When the perineum is of unusual depth, it may be difficult, especially for an inexperienced operator, to make a smooth section of the organ; perhaps the knife slips out of the groove of the staff, and, in attempting to reinsert it, it may be thrust in at a different point. Thus, the part may be nicked, as it were, and the consequence will be that the wound will be multiple instead of being simple, as it always ought to be. Again, harm may be done with the finger, in attempting to enlarge the wound of the prostate after slight incision has been practised. In general, however, there is little danger from this course. The most serious mischief is usually inflicted by the forceps, the blades of which, instead of being expanded over the stone, embrace a portion of the gland, and either bruise it severely, or tear it away from the body. The part of the organ most liable to suffer in this way is the enlarged middle lobe, as it lies behind the neck of the bladder in the form of a narrow ridge, or nipple-shaped prominence. The error can generally be readily detected by the peculiar feel of the tumor, which is soft and compressible, while the calculus is hard and unyielding. Where doubt exists, the instrument should be carried up into the cavity of the bladder after seizure has been effected, or the finger may be placed in contact with the body as it lies within the grasp of the forceps. In the former case, the instrument will refuse to ascend if it has hold of the prostate gland, and in the latter the discrimination is easily determined by the sense of touch. The accident, however, must be extremely rare, and ought never to happen in the hands of a skilful operator.

When the third lobe is in the way of the stone, it should be depressed with the finger; or, what is better, the *bas-fond* of the bladder should be elevated through the rectum; an expedient which will bring the stone on a level with the jaws of the instrument, and enable the operator to seize it with great facility.

When the prostate has been much contused, or lacerated, whether unavoidably, or through inadvertence, the best practice is to cut away the injured part with a pair of long, curved, blunt-pointed scissors, such as surgeons are in the habit of using for excising the uvula. The wound is thus converted into a simple one, which does not slough, but heals by the granulating process.

Where the stone is very large, the prostate may suffer excessive contusion during its extraction, followed by violent inflammation and even sloughing. In such a case, which is fortunately of rare occurrence, our chief reliance must obviously be upon the employment of antiphlogistic remedies, particularly leeches and ice to the perineum, in the early stage of the treatment, and, afterwards, upon fomentations and poultices.

A very disagreeable effect, but fortunately a very rare one, of the irregular division of the prostate gland, is the formation of a little flap, tongue, or pedicle, which, after the healing of the wound, may encroach upon the orifice of the urethra, and thus seriously impede the flow of urine. The part, in fact, produces very much the same trouble as hypertrophy of the middle lobe of this organ, described in another portion of the work.

A very curious case, illustrative of the ill effects of this flap-like valve, is mentioned by Sir Astley Cooper.¹ A Frenchman, cut with the gorget by Mr. Cline, recovered very well from the operation, but always thought that a fragment of stone had been left in the bladder, which was often irritable, and unable to expel its contents. He at length died, when it was ascertained that the calculus had been completely removed, but that the gorget on entering the bladder had nearly separated a small portion of the prostate gland, which had acted obstructingly to the passage of the urine, falling, like a valve, against the orifice of the urethra, when the man attempted to relieve himself. At such times he was obliged to remit his efforts, and experienced great distress, similar to that of stone in the bladder.

If the existence of such a body could, in any way, be determined during life, the proper remedy would be crushing, or strangulation by means of a silver wire, carried into the bladder by a large catheter. Or, these expedients failing, relief might be attempted by the lateral operation of lithotomy.

7. *Urinary Infiltration*.—One of the most frequent, as well as one of the most dangerous effects of lithotomy, is an escape of urine into the cellular tissue of the perineum, or of the perineum and the parts immediately around the neck of the bladder. Its occurrence is favored by too free a division of the prostate gland; by the small size of the wound, or by its being too conical or sloping; by the early and inordinate tumefaction of the cut surfaces; and, above

¹ London Lancet, vol i. p. 689.

all, by the perforation of the reflected portion of the pelvic fascia. The attack usually comes on within a short time after the operation, and is apt to run its course with frightful rapidity. A sense of weight, heat, and smarting at the neck of the bladder, and pain in the hypogastric region behind the pubes, attended with symptoms of excessive constitutional irritation, denote the commencement of the disease. The skin is hot and dry, the pulse weak and frequent, the tongue parched and brown, the wound glazed and fetid, the urine scanty and high colored. The prostration rapidly increases, the surface becomes covered with a cold, clammy sweat, hiccough sets in, the abdomen grows tympanitic, and the patient dies completely exhausted, usually in three or four days from the invasion of the malady. On dissection, the surfaces of the wound, the infiltrated parts, the neck of the bladder, and even the prostate gland, are all found in a highly inflamed, offensive, and sloughy condition. The pelvic portion of the peritoneum is frequently red, injected and incrustated with lymph.

Little can be done to arrest the progress of this affection when once established. Depletion by the lancet, and by purgatives is wholly inadmissible. The system, poisoned by the effects of the acrid urine, must be sustained, not further depressed. The internal remedies that promise most assistance are carbonate of ammonia, quinine, camphor, and capsicum, in combination with the liberal use of brandy and opium. Anodynes are indispensable from the very beginning. The best topical means are saturnine and opium fomentations, medicated cataplasms, injections of a weak solution of nitric acid or chloride of soda, and touching the whole track of the wound as early as possible with nitrate of silver or the tincture of iodine. When the infiltration is caused by the small size, ill shape, or improper direction of the wound, the defect must be remedied by the knife. An outlet should be made for the urine, either by means of the catheter in the urethra, or a tube passed through the artificial route. Leeches, hot fomentations, and blisters may be applied to the hypogastric region.

8. *Peritonitis*.—Peritonitis seldom follows the operation of lithotomy, whether performed at the perineum or above the pubes. It is, however, more frequent in the latter than in the former, because the peritoneum is more liable to be wounded, and because there is also more danger of urinous infiltration. In the perineal operation, it is exceedingly rare that the serous membrane of the pelvis is injured by the knife, but great mischief is occasionally done to the

bladder and the surrounding parts by rude and long-continued attempts at extracting the foreign body. From these and other causes, the disease in question is sometimes lighted up, more particularly in old persons whose constitution has been broken down by protracted suffering. It usually appears within the first thirty-six or forty-eight hours, and is ushered in by severe rigors alternating with flushes of heat, aching of the back and limbs, restlessness, and intense thirst. The distinctive signs are a burning pain of the abdomen with tenderness on pressure, tympanitis, a small, wiry, and frequent pulse, speedily followed by excessive prostration, cold, clammy sweats, hiccough, nausea or vomiting, and a cadaverous state of the features. The attack rarely lasts beyond the third day, and often terminates fatally in a much shorter period. The appearances after death are generally well marked, even when the disease has run its course very rapidly. The peritoneal surface is red and injected; the bladder and intestines are coated with lymph; and the pelvic cavity almost always contains a little turbid or bloody serum. Evidences of inflammation are also observed in the mucous membrane of the bladder.

The treatment must be prompt and vigorous. The practitioner must not be deceived by the state of the pulse, but the very fact that it is wiry and contracted must put him on his guard, and induce him to resort to depletion, both general and local, if the patient is in any condition to bear it. The quantity of blood to be taken must, of course, be regulated by the exigency of each particular case. Where the lancet is inadmissible, a goodly number of leeches may be applied to the hypogastrium, followed by fomentations, frequently renewed, and consisting simply of hot water, or of water in which hops, opium, or poppy-heads have been infused. When prompt relief does not follow this treatment, the whole abdomen should be covered with a blister. At the commencement of the attack, the warm bath occasionally proves highly serviceable, but later in the disease its beneficial effects are more than counterbalanced by the fatigue and exhaustion induced by its employment. The best internal remedies are calomel and opium, in the proportion of from three to five grains of the former to two, three, or even four of the latter, repeated every four, five, or six hours.

9. *Tetanus*.—Death after this operation has been known, in some instances, to be caused by tetanus. Of such an event, which must be very rare, especially in temperate climates and in healthy sub-

jects, I have no personal knowledge. Mr. F. H. Brett,¹ of Calcutta, states that he lost two patients by it out of twenty-two on whom he had performed the lateral section up to 1833. Should an attack of this kind be threatened, it must be promptly met with full doses of anodynes and antispasmodics, and, if the subject be much debilitated, by a liberal allowance of brandy, wine, or porter. When much suffering is present, chloroform will be found to be a valuable adjuvant in controlling muscular action.

10. *Explosion of Pre-existing Disease.*—Stone, as is well known, frequently coexists with other diseases, which, as long as the bladder is affected, often remain in a state of latency; or, at all events, make but little progress towards a fatal termination. As soon, however, as the vesical irritation is removed, they frequently acquire new intensity, and proceed with great vigor in the work of disorganization. The same thing is occasionally witnessed in anal fistulæ, complicated with tubercular phthisis. As long as the anal disease remains intact, the pectoral complaint may continue nearly or entirely stationary; but the moment such a patient is subjected to an operation, the tubercular malady takes a new start, and death takes place much sooner than it would have done had the fistule been let alone.

The organs which are most apt to suffer in this manner, are the kidneys, bowels, brain, heart, and lungs. Death may take place, suddenly and unexpectedly, within a few hours after the operation has been performed, or it may be postponed for a considerable period, perhaps several weeks or even months. The following cases and facts are in point, though they are designed to illustrate only a few of the more acute forms of these adverse occurrences.

In 1808, Mr., afterwards Sir, Everard Home cut a boy, aged seventeen, for stone in the bladder, after he had been for some time in a state of nervous depression, but which was not deemed to be a sufficient reason for delaying the operation. Nothing of an untoward character occurred during the operation; but, in the course of the following night, the patient died. The dissection revealed an inflamed and ulcerated state of the bladder, dilatation of the ureters, and a large abscess in each kidney. The immediate cause of the dissolution was found to be the bursting of the abscess in the right kidney, and the escape of half a pint of pus into the peritoneal cavity.²

¹ Trans. of the Medical and Physical Society of Calcutta, vol. vi. 1833.

² Brodie's Lectures on the Urinary Organs, p. 176. Phila. 1847.

Bright's disease, cystic degeneration, and calculous affections of the kidneys, often lead to fatal results after operations for stone in the bladder. The same is true of organic disease of the ureters, the prostate gland, and of the bladder itself. Hence, as elsewhere stated, the rule with nearly all lithotomists, especially the cautious and timid—those who have an eye rather to their own reputation than to the welfare of their patients—is never to meddle with any case where there is reason to believe that there is serious involvement of any portion of the urinary apparatus. The rule is, unquestionably, a good one; but the misfortune is that we cannot always make a proper application of it, on account of the difficulty of forming a correct diagnosis.

An elderly gentleman, from whom the late Mr. Crosse¹ of England, removed four calculi by cystotomy after the lateral method, and who had a brisk arterial hemorrhage two hours after being placed in bed, gradually sank into an exhausted and tympanic condition, without any pain or tenderness on pressure, and expired eight days after the operation. The dissection showed that the immediate cause of death was a gangrenous ulcer, not larger than a split pea, in the head of the colon, which, as well as the rest of the large bowel, was enormously distended with gas. The stomach and small intestines were sound, and there was an entire absence of peritonitis, suppuration, and urinary infiltration.

A few examples have occurred in which death has been caused by apoplexy, after this operation. The event is most liable to happen in elderly corpulent subjects, who, having long suffered from stone in the bladder, have led an indolent life, and have, perhaps, been affected with ossification of the cerebral arteries. One of my own patients, a man upwards of seventy years of age, died from apoplexy of the brain nearly two months after the operation, from the effects of which he had, apparently, entirely recovered.

11. *Wound of the Rectum.*—This accident may happen in any of the three stages of lithotomy; but it is not likely to occur, if the operation be performed in the manner advised in a previous chapter.² By gently depressing the bowel over towards the right side

¹ Treatise on Urinary Calculi, p. 89. London, 1835.

² Deschamps thinks that this accident is not so rare as is generally imagined, and adds that it occurred not less than four times in his own practice. (*Traité de la Taille*, t. iii. p. 327.) Cheselden acknowledged to Morand that he had twice, in operating, wounded the rectum. (*John Bell's Surgery*, vol. iv. p. 242.) The accident also occasionally occurred to Frère Côme. Deschamps says that the rectum is sometimes so

with the left index-finger, as the knife divides the deeper seated structures of the perineum and the membranous portion of the urethra, all danger of this kind is avoided. It is only by neglecting this precaution, or omitting to lateralize the knife sufficiently in this stage of the proceeding, that the rectum is likely to suffer. If the accident do occur, the opening will commonly be found to be small, and to be situated immediately in front of the neck of the bladder. There will be an interchange between the parts of urine and feces, the quantity of which varies in different cases, and the discharge of which may continue for an indefinite period. In general, however, it soon begins to diminish, and ceases altogether in fifteen or twenty days, or, at furthest, in a month. In children, the opening sometimes closes completely in less than a week; sometimes, indeed, by the first intention.

An accident of this kind is in general more disagreeable than dangerous. Unless the wound is very large, and the patient in dilapidated health, nature, assisted by art, is almost always competent to effect a cure. The proper plan of proceeding is to prevent the bowels from acting, except every third or fourth day, by means of anodynes, to wash out the rectum once every twenty-four hours with cold water, to permit none but the most bland and simple food, and to enjoin a strict observance of the recumbent posture. The suggestion of Pouteau, Desault, and others, to divide the parts that lie between the external orifice of the wound and the opening into the gut, cannot, I think, be too much deprecated. If the practice be at all justifiable, under any circumstances, it is only when the track has become fistulous or remained in this state sufficiently long to induce the conviction that it cannot be cured, either by the efforts of nature, or the means just pointed out. When the operation is unavoidable, it should be conducted upon the same principle as in anal fistule.

12. *Sloughing of the Rectum.*—Another accident which occasionally follows the operation of lithotomy is sloughing of the rectum. It is most liable to take place in weakly, dilapidated subjects, whose health has been much deteriorated by previous suffering, or who have the misfortune to be cut during the prevalence of erysipelas,

large as to cover nearly the sides of the prostate gland, and that it will then be almost impossible to avoid wounding it. (*Op. cit.* t. iii. p. 882.) I have recently heard a distinguished surgeon say, in conversing on this subject, that he had opened the rectum at least three or four times in about twenty operations, and without any serious consequences. He seemed to regard the accident as a mere bagatelle!

or within the walls of crowded and ill-ventilated hospitals. The immediate cause of the occurrence is probably slight infiltration of urine in consequence of the great and unnecessary depth of the wound, or injury done to the recto-vesical septum during the extraction of the calculus. The former may very easily happen if the knife be carried too closely to the coats of the bowel in dividing the prostate gland and neck of the bladder; and the latter, if the concretion be unusually large and rough, or if the parts be much bruised by the repeated introduction and pressure of the forceps.

The effect of such an accident, leaving out of the question the inflammatory symptoms, is similar to that of a rectal fistula, caused by the knife, only that the opening of communication between the bladder and the rectum will be likely to be much larger, and, consequently, more tardy in healing. No definite rules can be laid down respecting the treatment, which must evidently be regulated by the circumstances of each individual case. In general, it will be necessary to support the strength by a carefully regulated diet, and by tonics, especially quinine, wine, and brandy. The secretions must be properly attended to, and the parts must be kept clean by the frequent injection of weak solutions of soda, or the nitric acid lotion, which will, at the same time, tend to arrest the gangrene, and establish healthy action. The use of the knife should be studiously refrained from; for most of these cases, however threatening or apparently desperate they may be, are, provided the constitution is not too much exhausted, ultimately recovered from. Indeed, nowhere are nature's powers of repair more strikingly displayed than under circumstances of this kind.

13. *Incontinence of Urine.* — Incontinence of urine, consequent upon perineal lithotomy, is happily infrequent. It is not always easy to determine how this accident is produced. Occasionally there is reason to believe that it depends upon the irregular union of the edges of the wound, no matter how well the operation may have been executed. Most commonly, however, it arises from injury inflicted upon the neck of the bladder during the extraction of a large or very rough calculus, by which the parts are over-stretched, bruised, or lacerated. The loss of power of the sphincter muscle may be partial or complete. In the one case, the urine is retained for some time, and then passed involuntarily; in the other, it flows off drop by drop as fast as it reaches the bladder, and thus keeps the patient in a constant state of discomfort. In most

instances, the power of retaining the fluid is greater in the recumbent than in the erect or semi-erect posture, because less pressure is exerted by it upon the neck of the bladder in the former case than in the latter. The affection is usually accompanied by a sense of uneasiness, soreness, or burning at the lower part of the pelvis, or at the commencement of the urethra.

When there is a probability that incontinence of urine will take place, every effort should be made to prevent it. The patient should be strictly confined to his bed, a warm bath should be administered once a day, for twenty-five or thirty minutes at a time, tepid water should be frequently thrown into the rectum, and the urine should be deprived of its acrimony by the free use of demulcent fluids. When the affection is fully established, it will be necessary, in addition to these means, to leech the perineum occasionally, and to apply gentle but steady pressure upon that part with the pad of a T truss, or an instrument constructed upon the same principles as that which is sometimes worn for compressing the anus in prolapsus of the rectum. In obstinate cases, cauterization of the neck of the bladder and the commencement of the urethra may be tried with some prospect of success. Internally, the patient may use the muriated tincture of iron, strychnine, cantharides, and alkalies.

14. *Impotence*.—This, like incontinence of urine, is very rare after perineal lithotomy. As the operation is usually performed, the prostate gland is divided externally to the seminal ducts, which consequently remain intact. But even when they are accidentally wounded, it is doubtful whether any ill effects will result. When impotence follows the operation, it is almost always caused by violence done to the seminal ducts or their orifices during the extraction of the stone, terminating in inflammation and, perhaps, in slight gangrene. There is no remedy for its relief. Sometimes the patient is rendered impotent in consequence of the semen being nearly all discharged through a urethro-rectal fistule instead of the natural passage. Berard cites¹ a case of this kind in a young man of nineteen, who labored under this infirmity from having been cut for stone eleven years previously. Nearly all the semen flowed off by the rectum, and thus disqualified the individual for marrying.

15. *Perineal Fistule*.—The wound made in lithotomy generally heals in from three to four weeks; but sometimes it remains open much longer, and occasionally it does not close at all, but degene-

¹ Dict. de Médecine des Sciences Médicales, t. xxx. p. 124, 1846.

rates into a fistule. This may be owing to injury done to the bladder at the time of the operation; or it may be caused, more remotely, by ulceration or sloughing. In some instances, it is dependent upon the lodgement of sabulous matter, the impaction of a fragment of stone, or the constant intromission of thick, ropy mucus. Most of the water flows through the natural channel; only a small quantity escapes by the fistule. Sometimes the perineal opening is reduced down to the size of a thin bristle, and so continues for many years, now and then shedding a few drops of urine. The abnormal track, as all similar passages in other parts of the body, becomes gradually lined by an adventitious mucous membrane. The existence of the fistule is determined by the appearance of the urine at the external opening, and by an examination with a probe.

The treatment consists in retaining a silver catheter constantly in the urethra, and in cauterizing, every sixth, eighth, or tenth day, the neck of the bladder with nitrate of silver. The patient should be confined to his back, with the nates resting continually higher than the other parts of the body, in order that the urine may be prevented from coming in contact with the inner orifice of the fistule. When the track is unusually small, and the perineum uncommonly thin, relief may sometimes be afforded by the occasional introduction of a heated probe wire or knitting-needle. In obstinate cases, when the ordinary remedies have proved unavailing, the parts should be divided with the knife, as in the first instance, though much less extensively. It has been found that a fistule of this kind, produced by a first operation, has been radically cured by a second. All foreign substances, obstructing the artificial route, must of course be removed as early as possible.

c. Time occupied in Performing the Operation.—A few remarks will not be amiss here respecting the time occupied in performing this operation. This must necessarily vary according to many circumstances, of which the principal are, the dexterity of the surgeon, the character of the assistants, the size of the wound, and the volume of the calculus, together with its freedom from adhesion, and the facility with which it may be seized with the forceps.

Manual skill can be acquired only by experience, and is often obtained at great expense to the patient, and no little anxiety and distress to the operator. Hence, however well prepared by education and habit, his first attempts will probably not be the most

brilliant, or the most gratifying to his vanity. The patient will be likely to be kept unusually long upon the table; the wound will be too small, or the calculus will be attached, misplaced, or too large. In fact, every reason is assigned for the delay but the right one. I recollect in my first case, that a number of minutes elapsed before clearance of the bladder was effected, and the patient untied. The delay arose from the difficulty I experienced in withdrawing the stone, which seemed to me, at the time, to be attached to the bas-fond of the bladder, but which, in reality, as I now believe, was only disproportionably large to my incision in the neck of the bladder and the prostate gland. Had this been a little longer, the extraction would probably have been effected in one-fourth the time. As it was, I was obliged to dilate it with the bistoury before I attained my object. The patient, however, had a speedy recovery; a circumstance which atoned, in some degree, for my dilatory movements. Of late years, a minute or two have sufficed to do the business; and, on one occasion, not long ago, I made my incision and extracted a calculus in thirty seconds. I have heard of a young surgeon consuming an hour and twenty-six minutes in the operation, although there was nothing unusual in the case; and yet his patient recovered. In one of my own cases, I was nearly a quarter of an hour at work; but then there was an immensely deep perineum, and an excessively elongated bladder, with fifty-four calculi. It is not always the most rapid and brilliant operation that is the most successful. Le Cat cut half a dozen individuals in nearly twice as many minutes, and lost nearly every one. Rapidity is certainly highly commendable; but it should never be at the expense of the patient's safety. No lithotomist should cut against time. His motto should be, *festina lente*; the rule of his conduct, *respice finem*. He should *feel* his way in every step of the operation; and never, for a moment, lose his self-possession.

A great deal depends upon one's assistants in this operation. If these are experienced, or well trained, everything moves in concert; the patient is thoroughly held upon the table, the limbs are properly secured, the staff is in its right place, and the instruments are handed in the order in which they are needed. If an artery spring, a finger is ready to compress it; in short, all the surgeon's wants are anticipated. Thus, everything like confusion is prevented; the operation, once commenced, is proceeded with until it is completed.

Much delay, of an unavoidable kind, may arise from the size of the stone, or from its situation in the bladder. For this the operator is not responsible. Vexatious delay is also sometimes occasioned by the protrusion of the rectum, at the moment the surgeon begins his incisions, or immediately after. For this, too, he is not blamable. The size of the wound, especially the deep portion, cannot always be regulated beforehand. It may require to be enlarged; but this never seriously protracts the operation. In several of my cases, slight embarrassment arose from inordinate straining and bulging of the perineum, the patient being at the time under the full influence of chloroform.

f. Operation at Two Periods, or operation "en deux temps."—It occasionally happens, during the extraction of a stone, that the patient becomes greatly exhausted before the operator is able to accomplish his object, and when, perhaps, a continuance of his efforts might seriously jeopard his life. This event may depend upon several circumstances, the principal of which are referable to the stone itself, as its extraordinary bulk, its attachment to the bladder, its lodgement in a distinct cyst, or its situation above the pubes. It may also be caused, at least in part, by hemorrhage—copious, it may be, and difficult of management—so that, before extraction can be effected, the patient may be faint, and unable to endure further interference. To meet this contingency, it has been proposed to suspend all proceedings, and to defer the extraction of the stone till some future occasion, not too remote from the first. This operation, it may now be observed, constitutes what the French surgeons call the operation *en deux temps*; that is, literally, an operation performed at two different periods.

The names of many of the older and more respectable lithotomists might be adduced in favor of this method, which, however, thanks to modern science and skill, is rarely adopted at the present day. The earliest mention of it is by Celsus, who deprecates all rough and protracted attempts at extracting calculi, on account of their tendency to excite violent, if not fatal inflammation. He observes that patients who have been cut have occasionally perished from long-continued and fruitless efforts in searching for a concretion, which, when small, has been known to be forced down by the urine, and to escape by the wound. The same practice was afterwards particularly recommended by Franco and Fabricius Hildanus. Albucasis likewise expresses himself in favor of it, but only in

cases of hemorrhage, which, at that period of the profession, were very common, and proved a source of considerable mortality. Collet, Saviard, Tolet, and other French lithotomists, occasionally performed the operation. In 1710, Professor Thompson, of Edinburgh, had recourse to it in an instance where, by "his prudence and forbearance," he is supposed to have saved his patient. The practice has never been in favor in Great Britain; and, in the United States, I am not aware that it has ever been adopted.

Franco, it would seem, was the first who gave a full and connected account of this method.¹ His experience taught him that there are cases where the patient suffers much from the violence of the operation, and where, consequently, it would be extremely hazardous to proceed, inasmuch as fatal exhaustion might ensue, and death occur on the table. Under such circumstances, he directs the lithotomist to desist, and to put the patient to bed, the treatment being conducted upon general principles. After a few days, when the fever has abated, the stone will often be found so situated as to admit of extraction by the usual means. If it do not present itself at the mouth of the wound, he advises that the finger be introduced into the rectum, and the abdomen compressed above the pubes, to force the concretion to the neck of the bladder, where it may be more easily seized. If the stone be of extraordinary bulk, it should be broken with strong forceps, and removed piecemeal.

There is no probability that the operation *en deux temps* will ever again become fashionable. Modern lithotomists are too expert in the use of the knife and forceps to render it necessary to employ an expedient which must be regarded as the resource only of dulness and stupidity. A thorough knowledge of the anatomy of the perineum, a rapid performance of the operation, and the use of chloroform, render the whole proceeding comparatively easy, both for the surgeon and the patient. Where the stone is unusually bulky, which, however, rarely happens at the present day, the incision of the prostate must be comparatively enlarged, or, where this has already been carried to a proper and safe extent, the foreign body must be crushed, and extracted piecemeal; and this, too, is generally, in the hands of a skilful operator, the matter of a few minutes. Where the concretion is encysted, or adherent, it is

¹ See the excellent paper of Mr. H. Earle on Extraction of Large Calculi, in the eleventh volume of the Medico-Chirurgical Transactions of London.

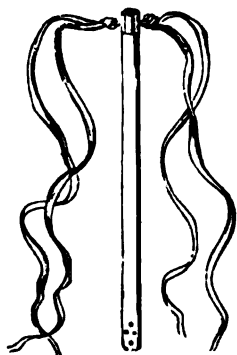
detached with the finger, scoop, or bistoury. In short, it is only where the stone, besides being very voluminous, is excessively hard, and cannot be broken without the greatest difficulty; or where it is so small that it cannot be found without the most protracted search; where the patient has lost a large quantity of blood; or, finally, where there is excessive shock; it is only, I repeat it, under such circumstances, that the operation will ever be likely to be required.

g. After-Treatment.—As soon as the stone is extracted, and it has been ascertained that there are no bleeding vessels requiring a ligature, the patient is untied, sponged, and carefully carried to bed by one or two assistants. As he is obliged to remain in the recumbent posture from ten to twenty days, it is very important that he should be rendered as comfortable, in every respect, as possible. The bed upon which he is to lie, and which should always be properly arranged before the operation, should be provided with slats and a cotton, moss, or hair mattress. Feathers are never to be used, as they permit the nates to sink into them, and keep both part and system too warm. The mattress is covered with a sheet, over which is spread a large piece of soft oil-cloth, to protect the bedding from urine and blood. Another sheet, called the draw-sheet, folded several times, and arranged so as to make the middle of it correspond with the buttocks, is placed upon the top of the oil-cloth, and serves to ward off pressure, as well as to receive the secretions as they flow from the wound. The head and shoulders should be slightly elevated by a pillow.

My experience has taught me that it matters little, if any, what posture the patient assumes after he has been put to bed. I usually, however, request him to lie on his right side for the first five or six hours, to afford the lips of the wound an opportunity of becoming glazed with lymph before he is obliged to urinate. At the end of this period, and, indeed, often much earlier, I permit him to rest upon his back, or upon either side, as may be most agreeable to him. Young subjects, unless they are incessantly watched, will seldom remain in the same posture beyond a few minutes, and I must confess I have yet to see a case in which any detriment resulted from this source.

It is equally unnecessary, in my judgment, to tie the patient's knees together after the operation is over, and he has been put to bed; or to introduce a tube into the bladder by the wound, for the purpose of conducting off the urine, and thus preventing infiltration

Fig. 132.



of the surrounding cellular tissue. This expedient, which was already insisted upon by Collet, early in the last century, and which has been advocated, as a rule of practice, by some highly respectable surgeons of the present day, can neither be necessary nor proper, except in those cases in which the incisions have been made, either through inadvertence or design, unusually extensive. When the operation has been properly performed, or when the parts have been divided with the requisite care and attention, such a contingency must be exceedingly rare. Indeed, I consider the practice not

only as useless in reference to the object proposed, but as eminently calculated to prove mischievous. The contact of the tube with the surface of the bladder must necessarily tend to excite inflammation of the mucous membrane, to create pain and spasm at the neck of the organ, to fret and irritate the wound, and to produce a constant desire to pass water.

No surgeon at the present day thinks of interposing a tent between the lips of the wound, or of applying cataplasms, cold lotions, or warm fomentations for promoting its cure. Such practice has been long since exploded, and it is not likely to be ever revived. The rule here is, as in all similar cases, to keep the parts cool and unencumbered.

The urine sometimes begins to flow by the wound in a few minutes after the operation; but, in general, little or none passes for the first four or five hours. It then usually comes away in a gush, attended frequently with severe pain and spasm of the neck of the bladder. The first discharges are commonly sanguinolent, and therefore leave a characteristic stain upon the sheet. By the end of the first day, the edges of the wound are generally so much swollen that the urine ceases to flow through the perineum, and takes the course of the urethra. This, however, rarely continues beyond twenty-four or thirty-six hours, when the tumefaction alluded to has usually so far subsided as to allow the fluid to flow in its original direction, not in gushes, but in an occasional stream, or drop by drop. The period at which the urine begins to pass off permanently by the urethra varies from ten to fourteen days. Occasionally, however, I have known it to happen as early as the eighth day and as late as the twentieth. The change in the direction of the fluid is generally

attended with more or less pain at the neck of the bladder, and a scalding, smarting, or burning sensation in the urethra and head of the penis.

The treatment after the operation must be strictly antiphlogistic. The patient is kept quietly upon his back, and all excitement, both bodily and mental, is sedulously guarded against. The pain consequent upon the operation is often extremely severe, and is generally referred to the neck of the bladder. It is of a cutting, darting, or burning character, and is either continued or it comes on in frequent paroxysms. It generally makes its appearance immediately after the operation, and is sometimes so severe as to cause the patient to scream out at the top of his voice. To arrest this suffering as speedily as possible, as well as to allay the general agitation which is so frequent a concomitant of lithotomy, a full anodyne should be administered, generally within a few minutes after the patient has been removed to his bed. If he be an adult, he should take not less than one grain of morphia, or its equivalent of solid opium or laudanum. To administer a smaller dose than this would only be temporizing. The pain must be allayed promptly and effectually, otherwise it may be productive of serious mischief, as exhaustion, convulsions, or inflammation.

Demulcent drinks should be used freely throughout the treatment, especially during the first few days. They not only allay thirst, but, what is of great importance, they dilute the urine, and diminish its acrid qualities, thus rendering it more acceptable both to the bladder and the wound. They may consist of elm-bark water, flaxseed tea, or gum Arabic water, and they may be simple, or combined with nitrate of potassa, bicarbonate of soda, or dilute nitric acid, according to the particular indication of each case.

The diet must be light, unirritant, and of the most simple kind. For the first few days, the patient should take little else than water panada, thin gruel, or weak chicken broth. After that he may use a little rice, toast and tea, a few crackers, or a small quantity of mush and milk. No meat or vegetables should be permitted under twelve days or a fortnight. It should be remembered that the slightest indiscretion in diet may greatly retard recovery, or even jeopard life. The patient should consider himself as an invalid, and govern his appetite accordingly. Of course, there are exceptions to all rules. Thus, a patient may be in such infirm health as to require a nourishing diet, tonics, and stimulants, from the very commencement of the after-treatment. Much judgment is doubtless

required to enable the practitioner to decide when such a plan is proper, and it is obvious that no specific rules can be laid down for his government.

In all cases, I make it a rule to prevent any action of the bowels for the first three days. I have always pursued this practice, under a conviction that the less the rectum is disturbed the better it will be for the bladder. For this purpose, I invariably give a full anodyne immediately after the operation, even where it may not be necessary on account of the pain and general agitation. Where care is taken to clear out the alimentary canal thoroughly before the operation, the patient cannot suffer any possible inconvenience from the want of an evacuation during the period here specified. At the end of this time, I generally order a dose of castor oil or Epsom salts, assisted, if the purgative is tardy in its action, by an enema of tepid soap-suds. The same, or other means may be resorted to afterwards to keep the bowels in a soluble condition. If, during the progress of the case, the patient's tongue becomes coated, and his appetite impaired; or if his general health suffers; or if he does not improve as well and as rapidly as he ought; or, finally, if the urinary secretion is loaded with mucous and earthy matter; the best remedy he can use is a dose of calomel, which often, in these circumstances, acts like a charm in promoting recovery.

The draw-sheet is frequently renewed, and every possible attention paid to cleanliness. Sometimes the patient's comfort is greatly promoted by a soft sponge, or an old napkin, placed beneath the perineum, and arranged so as not to compress and obstruct the wound. The urine is thus imbibed as fast as it flows off, and the consequence is a less frequent necessity for a change of bed and body clothes. Excoriations of the nates and neighboring parts must be prevented by frequent ablutions; and the scrotum must be kept out of the way of the wound by a suspensory bandage.

During the progress of the treatment, it sometimes happens that the edges of the wound become incrustated with earthy matter, forming a thin, whitish sheet, which adheres quite firmly to their surface. The occurrence is not productive of pain; but, as it prevents the formation of healthy granulations, it serves to retard the reunion of the parts, and should, therefore, be promptly attended to. The deposit is of a phosphatic character, and hence the best remedy is the nitric acid lotion, in the proportion of about four drops to the ounce of water, applied by means of a folded cloth. When the incrustation extends far back, the fluid may be injected once or twice

daily into the bladder. In most cases, the local application should be aided by the internal exhibition of the remedy.

When the wound is tardy in healing, or has contracted to a mere orifice, a catheter ought to be permanently retained in the bladder, to conduct off the urine through the natural channel. The walls of the urethra being then equally distended, and the sides of the wound compressed, a cure sometimes follows in a few days.

The wound made in this operation occasionally unites by the first intention; but such an event, desirable as it certainly is, is rarely to be looked for. The nearest approach to it in my own practice happened during the last year, in two little boys, aged three years, remarkable for the excellence of their general health. The urine in both passed off entirely by the natural channel after the second day, and the wound was nearly cicatrized at the end of a week. It is not improbable that some operators may have better luck in this respect than others. Thus, we find that Dr. Dorsey,¹ whose experience as a lithotomist was limited, speaks of having met with two cases in which the parts healed by the first intention, and he refers to a similar instance observed by Dr. Physick. Professor Dudley,² of Lexington, witnessed the same circumstance eight times in one hundred and thirty-five cases. Six of the patients had each a single calculus; one had two—both of considerable size, and requiring unusual effort at extraction—and the other had thirteen. Mr. Crichton,³ of Dundee, Scotland, had union by the first intention in twenty-three out of two hundred cases operated on by him; a result which, so far as I know, is without a parallel. A detailed account of most of these cases will be found in the forty-eighth volume of the *Edinburgh Medical and Surgical Journal*, and is well worthy of an attentive perusal.

In speculating upon this subject, it is difficult to perceive why, all other things being equal, the wound in one case should unite more readily by the adhesive process than in another; or, more properly speaking, why it should unite at all in one and not in another. I do not recollect a solitary instance among my own operations, in which the parts were seriously bruised in the extraction of the calculus, or unduly divided in making my deep incisions, yet, as has been already stated, I have never had a case of union

¹ Elements of Surgery, vol. ii. p. 158. Phila. 1818.

² Transylvania Journal of Medicine and the Associate Sciences, vol. ix. p. 288. 1836.

³ British and Foreign Medico-Chir. Review for July, 1854, p. 158, Amer. ed.

by the first intention, properly so called. Dr. Dudley, who used the gorget in all his operations, seems inclined to ascribe the occurrence, not so much to the character of the instrument used, the accurate correspondence between the size of the wound and the volume of the calculus, or the small number of times the forceps are introduced into the bladder, as to the thorough preparation of the system before the operation, and the attention that is paid to the patient's position, diet, and secretions after it has been performed. That these circumstances exert a most favorable influence upon the healing process, is unquestionable; but if they do this in one case, why do they not do it in another? Dr. Dudley, as is well known, always prepared his patients with the utmost care, and it may be fairly presumed that he never neglected them after the operation, and yet eight cases of union by the adhesive process are all out of one hundred and thirty-five operated on by him up to 1836. Mr. Crichton, who employs both the gorget and the knife, distinctly declares that the event in question can be reasonably expected only in cases where the subject is of sound constitution, where the calculus is of moderate size and easily extracted, and where the urethra and prostate are neatly and accurately divided, and not hacked, as occasionally happens, especially with young and inexperienced operators.

On the whole, it may reasonably be concluded that a good sound constitution, early childhood, a neat division of the parts, a moderate-sized wound, a small calculus, great gentleness in the use of the forceps, and great attention to cleanliness, quietude, and diet, with an avoidance of alvine action for the first few days after the operation, are the conditions most favorable to the result under consideration. Unfortunately, however, such a combination of circumstances can seldom be expected in the same individual, and hence union by the first intention will always be the exception, and not the rule, after the operation of lithotomy, no matter by whom, or however carefully performed.

h. Statistics.—I have been at much pains to collect the statistics of the results of the lateral operation of lithotomy, as performed by the principal surgeons of the United States, but a reference to the subjoined table will serve to show that my success, in this respect, has not been as great as could have been desired. The difficulties which have attended this part of the inquiry have been very great, and can only be correctly appreciated by those who have been engaged in similar pursuits. No data, on an extended scale, illus-

trative of this topic, have yet been furnished by the lithotomists of this country; a circumstance which is so much the more to be regretted, as the results would, I am quite sure, place them in the very foremost ranks in this department of operative surgery. To contrast these results with those of European lithotomists, I have arranged, with much care, in tabular form, all the authentic and reliable facts bearing on this subject, as I have found them in various monographs, systematic treatises, and periodicals.

TABLE I.—*Showing the Results of 895 Cases of the Lateral Operation of Lithotomy, in the practice, chiefly private, of American Surgeons.*

Operators.	Cases.	Instrument.	Cures.	Deaths.	Proportion.
Ephraim McDowell ¹	32	Gorget & knife	32	...	
Nathan Smith ²	23	Gorget	20	3	1 in 7½
George McClellan ³	21	Knife	21	...	
B. W. Dudley ⁴	207	Gorget	201	6	1 in 84½
Valentine Mott ⁵	162	Knife	155	7	1 in 27
J. P. Mettauer ⁵	91	Gorget	87	4	1 in 22½
Alban Goldsmith ⁵	58	Knife	55	3	1 in 19½
N. R. Smith ⁵	45		42	3	1 in 15
William Gibson ⁵	50	Gorget	44	6	1 in 8½
J. R. Barton ⁵	36	Knife	32	4	1 in 9
Amasa Trowbridge ⁵	18	Gorget	18	...	
R. M. Mussey ⁵	15	Knife	14	1	1 in 15
A. H. Stevens ⁵	15	Knife	15	...	
W. Gardner ⁵	15	Knife	14	1	1 in 15
C. H. Pope ⁵	14	Knife	13	1	1 in 14
Alden March ⁵	12	Knife	11	1	1 in 12
J. C. Nott ⁵	12	Gorget	12	...	
J. Dickson ⁵	14	Knife	14	...	
J. M. Bush ⁵	7	Gorget	7	...	
D. W. Yandell ⁵	8	Knife	7	1	1 in 8
S. D. Gross	40	Knife	37	3	1 in 13½
	895	G. 426; K. 424	861	44	1 in 20½

It will be perceived that, of the above surgeons, twelve operated with the knife, and seven with the gorget. Dr. Ephraim McDowell employed, as is assumed, the knife in one-half of his cases, and the gorget in the other half. The instrument used by Dr. N. R. Smith is not mentioned, but the probability is that it was one of peculiar construction, of which he professes to be the inventor, and which he has described and delineated in the *Medical and Surgical Memoirs* of his father, published at Baltimore in 1831. It is a singular, and

¹ Gross's Report on Kentucky Surgery, p. 40. Louisville, 1853.

² Medical and Surgical Memoirs. Edited by N. R. Smith, M. D. Baltimore, 1839.

³ Cooper's Surgical Dict. Appendix by Dr. Reese, art. Lithotomy. 1842.

⁴ Gross, *op. cit.* p. 95.

⁵ MS. Letter to the Author.

also a very interesting fact, that the two classes of cases are nearly equal in number—the gorget cases amounting to 426, and the knife cases to 424—affording thus, as will be seen by a reference to the table, a mortality for the former of 1 in 23 $\frac{1}{3}$, and for the latter of 1 in 19 $\frac{4}{11}$.

TABLE II.—*Showing the Results of 1,596 Cases of the Lateral Operation of Lithotomy, in the private and hospital practice of European Surgeons.*¹

Operators.	Cases.	Instrument.	Cures.	Deaths.	Proportion.
William Cheselden, ² London . . .	218	Knife	198	20	1 in 10 $\frac{1}{2}$
Claude Pouteau, ³ Lyons . . .	120	Lithotôme	117	3	1 in 40
Vincent Kern, ⁴ Vienna . . .	834	Knife	803	31	1 in 10 $\frac{1}{2}$
Mormeaux, ⁵ Brussels . . .	33	Knife	31	2	1 in 16 $\frac{1}{2}$
P. M. Martineau, ⁶ Norwich . . .	84	Knife	82	2	1 in 42
Burnard, ⁷ Bengal . . .	22		17	5	1 in 4 $\frac{1}{2}$
Robert Liston, ⁸ London . . .	115	Knife	99	16	1 in 7 $\frac{1}{2}$
B. B. Cooper, ⁹ London . . .	184	Knife	125	9	1 in 14 $\frac{1}{2}$
Petruni, ¹⁰ Naples . . .	22		19	3	1 in 7 $\frac{1}{2}$
J. M. Vericel, ¹¹ Lyons . . .	109		100	9	1 in 12 $\frac{1}{2}$
William Keith, ¹² Aberdeen . . .	23	Knife	22	1	1 in 23
J. M. Chelius, ¹³ Heidelberg . . .	22		21	1	1 in 22
John Crichton, ¹⁴ Dundee . . .	200	Gorget & knife	186	14	1 in 14 $\frac{1}{2}$
Salvatore de Renzi, ¹⁵ Naples . . .	47		38	9	1 in 5 $\frac{1}{2}$
Campanella ¹⁶ . . .	10		10	...	
F. H. Brett, ¹⁷ Calcutta . . .	108	Knife	101	7	1 in 16 $\frac{1}{2}$
Total . . .	1596		1484	182	1 in 12 $\frac{1}{3}$

I have purposely excluded from the above table the cases of M. Hildenbrand, of Moscow, not knowing whether the reference to

¹ It will be seen that the names of Dr. Burnard and Dr. Brett, of India, are embraced in this list.

² *Anatomy of the Human Body.*

³ *Mélanges de Chirurgie*, p. 198. Lyons, 1760.

⁴ *Rust's Handbuch der Chirurgie*, vol. x. p. 298. 1833.

⁵ *Uytterhoeven, Arch. de la Médecine Belge*, t. vii. p. 44. 1842.

⁶ *Memoir of the late P. M. Martineau*, p. 38. Norwich, 1831.

⁷ *Trans. Med. and Physical Society of Calcutta*, vol. v. 1831.

⁸ *Coulson on Lithotrity and Lithotomy*, p. 374. London, 1853.

⁹ *Lectures on Surgery*, p. 494. Philad. 1852.

¹⁰ *Johnson's Medico-Chir. Review*, N. S., vol. xxii. p. 196. 1835.

¹¹ *British and Foreign Medico-Chir. Review*, vol. x. p. 208. 1852.

¹² *Edin. Med. and Surg. Journ.* vol. lxi. p. 396. 1844.

¹³ *Coulson, op. cit.* p. 377.

¹⁴ *British and Foreign Medico-Chir. Review*, July, 1854, p. 159. Amer. edition.

¹⁵ *Gazette Médicale de Paris*, No. 87, 1839; *Amer. Journ. Med. Sciences*, vol. xiv. p. 464; also, *Lond. and Edin. Monthly Journ. Med. Science*, p. 600, 1841.

¹⁶ *Gazette Médicale de Paris*, Sept. 1839; *Amer. Journ. Med. Sci.* vol. xiv. p. 461.

¹⁷ *Surgical Diseases of India*, p. 500. Calcutta, 1840.

them, the only one I have seen, in the *Quarterly Journal of Foreign Medicine and Surgery*, for January, 1821, is reliable. In this periodical, it is stated that this surgeon had cut 1,500 cases, with a loss of only 30. If these cases be added to those given in the table, we shall have an aggregate of 3,096 operations, and 162 deaths; or a mortality of 1 in 19½, a result which few, if any, other capital operations can pretend to rival. No surgeon, however, it seems to me, who knows anything of lithotomy, will be willing to admit that it is possible for any man, however scientific and dexterous, to cut 1,500 persons and lose only 30. Such an occurrence is possible, but not at all probable, and would hardly happen even in so simple an operation as the amputation of the hand or foot. Martineau, whose success has always been considered as amongst the most extraordinary and brilliant in surgery, lost 1 in 42, or 2 in 84 cases; Pouteau, 1 in 40, or 3 in 120 cases; and Dudley, 1 in 34, or 6 in 207 cases. The operations of Hildenbrand, on the contrary, afford 1 death in 50 cases, and that, it should be remembered, not in 100, 200, or 300 cases only, but in 1,500; a degree of success which even Rau, who has been said, absurdly enough, to have lithotomized upwards of 1,500 patients without losing a single one, might justly have envied.

TABLE III.—*Showing the Results of 2,967 Cases of the Lateral Operation of Lithotomy in different hospitals.*

Locality.	Number.	Cures.	Deaths.	Proportion.
Pennsylvania Hospital	88	78	10	1 in 8½
Lunéville Hospital	365	332	33	1 in 11½
Hôtel-Dieu, Paris	89	80	9	1 in 4½
La Charité, Paris	34	19	15	1 in 2½
Hôpital des Enfants, Paris . . .	60	51	9	1 in 6½
St. Mary's, Moscow	411	369	42	1 in 9½
Norwich Infirmary	704	611	93	1 in 7½
Bristol Infirmary	354	275	79	1 in 4½
Leeds Infirmary	197	169	28	1 in 7½
St. Thomas's Hospital, London .	144	129	15	1 in 9½
Royal Infirmary, Aberdeen . . .	23	22	1	1 in 23
Loretto Hospital, Naples	553	471	82	1 in 6½
Total	2967	2551	416	1 in 7½

I am not able to state in what proportion of the above cases, respectively, the knife and gorget were used. A number of the patients at the Pennsylvania Hospital were, doubtless, operated on with the latter instrument; at the Lunéville Hospital, it was employed in all the cases; and, at St. Thomas's Hospital, in probably more than half. At Norwich, Bristol, Leeds, and Aberdeen, the

knife was more frequently used than the gorget. In the Parisian hospitals, the knife and lithotôme were employed. The sex is stated in only 1,016 cases, of which 42 were females, and the rest were males. The whole of Mons. Guërsent's patients were children.

The results of the lateral section are, as was before stated, materially affected by the *age* of the patient. It is generally supposed that children recover most readily from the effects of the operation, and the opinion, although not without exceptions, is, in the main, well founded. The subjoined tables are adduced in illustration of the subject. The first affords an account of Mr. Cheselden's cases, and is the more interesting and valuable, as it exhibits, in bold relief, the fruits of the first trials of the lateral method, as practised at the present day. In the second, constructed by the late Mr. Crosse, of England, and based upon 704 operations, performed at the Norfolk and Norwich Hospital, the least mortality, during any one of the decennial periods, was from the thirty-first to the fortieth year; the greatest, from the sixty-first to the seventieth.

I. *Table of Cheselden's Operations.*

	Ages.	Cases.	Cures.	Deaths.	Proportion.
From	1 to 10 . . .	105	102	3	1 in 35
"	10 to 20 . . .	62	58	4	1 in 15½
"	20 to 30 . . .	12	9	3	1 in 4
"	30 to 40 . . .	10	8	2	1 in 5
"	40 to 50 . . .	10	8	2	1 in 5
"	50 to 60 . . .	7	3	4	1 in 1½
"	60 to 70 . . .	5	4	1	1 in 5
"	70 to 80 . . .	2	1	1	1 in 2
Total . . .		213	193¹	20	1 in 10½

II. *Table of 704 Cases at the Norfolk and Norwich Hospital.*

	Ages.	Cases.	Cures.	Deaths.	Proportion.
From	1 to 10 . . .	281	262	19	1 in 14½
"	11 to 20 . . .	106	97	9	1 in 11½
"	21 to 30 . . .	48	43	5	1 in 9½
"	31 to 40 . . .	48	45	3	1 in 16
"	41 to 50 . . .	47	37	10	1 in 4½
"	51 to 60 . . .	96	71	25	1 in 3½
"	61 to 70 . . .	70	50	20	1 in 3½
"	71 to 80 . . .	8	6	2	1 in 4
Total . . .		704	611	93	1 in 7½

¹ The calculi in three of these cases weighed, respectively, eight, ten, and twelve ounces. The greatest number of concretions in any one of the patients was thirty-three.—*Cheselden's Anatomy*, p. 333. Boston, 1806.

Of 60 children cut by Mons. Guërsent, at the Hôpital des Enfants, Paris, 9 died, being in the ratio of 1 to 6 $\frac{3}{4}$. On the other hand, of 56 children operated on at St. Thomas's Hospital, London, only 1 perished; a result by far the most brilliant of the kind on record. Three-fourths of the patients lithotomized by Dr. Dudley—207 in number—were under 15 years of age. Of Mr. Martineau's 84 cases, 26 were from 1 to 10 years, 13 from 10 to 20, 9 from 20 to 30, 7 from 30 to 40, 4 from 40 to 50, and 25 from 50 to 80. The loss of the American lithotomist was 1 in 34 $\frac{1}{2}$; of the English, 1 in 42.

Dr. Marcet, in his *Treatise on Calculous Disorders*, published in 1817, estimates the average proportion of deaths from the lateral operation in England to be 1 in 5, and 1 in 7 $\frac{1}{2}$ for the cases—506 in number—at the Norwich Hospital. The mortality at this institution from the operation in children, up to that period, was only about 1 in 18; while in adults it was about 1 in 4, or nearly quadruple. According to the recent calculations of Mr. Coulson, the average mortality in England, as deduced from 1,743 cases, is 1 in 6.93; in France, in 582 cases, 1 in 5.70; and, for Europe generally, 1 in 5.14.

The size of the calculus also exercises an important influence upon the results of the operation of lithotomy, not only when performed according to the lateral method, but every other. The subjoined table, compiled by Mr. Crosse, gives the weight of the calculus, and the mortality, in 704 cases operated on at the Norwich Hospital.

Table showing the Mortality of the Lateral Operation, as influenced by the Size of the Calculus.

Weight in ounces.	Cases.	Cures.	Deaths.	Proportion.
1 ounce and under . . .	529	482	47	1 in 11 $\frac{1}{4}$ ²
1 to 2 ounces	119	101	18	1 in 6 $\frac{1}{2}$ ¹
2 to 3 "	35	19	16	1 in 2 $\frac{3}{8}$ ⁶
3 to 4 "	11	4	7	1 in 1 $\frac{1}{2}$
4 to 5 "	5	2	3	1 in 1 $\frac{1}{2}$
5 to 6 "	2	2	...	
6 to 7 "	2	...	2	
7 to 8 "	1 ¹	1	...	
Total	704	611	93	1 in 7 $\frac{5}{8}$

The average size of the calculi in Dr. Dudley's cases, as I am informed by Dr. Bush, was less than that of a pullet's egg, the

¹ This calculus was situated in the scrotum, and the case cannot, therefore, be regarded as a successful example of the regular lateral section.

weight of the largest being 9 ounces, and its circumference $11\frac{1}{2}$ inches. The smallest concretion in Martineau's cases weighed only a few grains; the largest, $5\frac{1}{2}$ ounces; the majority not exceeding 2 drachms.

The circumstances which tend to influence the results of the lateral—as, indeed, of every other operation of lithotomy—are exceedingly numerous and diversified in their character; and are worthy of the most profound study and consideration. The most important of these circumstances are referable, first, to the skill of the surgeon; secondly, to the manner of preparing the patient's system; thirdly, to the age and health of the patient; fourthly, to the nature and volume of the concretion, and its situation in the bladder; and, lastly, to the selection of our cases. Children are, all other things being equal, better subjects for the operation than adolescents, adults, and aged persons; a large or an encysted calculus will be more likely to produce mischief, during its extraction, than one that is small, or free; and a sickly individual, or one whose constitution has been impaired by protracted disease, will run more risk than a healthy one. Then, again, a great deal apparently depends upon sheer luck. Thus, an operator will occasionally have the good fortune to cut twenty or thirty cases in succession, without, perhaps, losing a single one, and he is disposed to congratulate himself upon his infallibility; all at once, however, the tables are turned against him, and the next two or three patients slip through his hands, and that, too, perhaps, without any appreciable cause. His good luck has forsaken him, and, by the time he reaches his fiftieth case, he has the mortification to see that his victories, like those of a skilful general, have not been achieved without a certain number of victims.

It is said that Frère Jacques cut 36 patients in succession without losing a single one. M. Vèricel, of Lyons, had 53 consecutive recoveries; Mr. Brett, of Calcutta, 68. Of 38 cases operated on at the Norwich Hospital, previously to 1834, by Crosse, Dalrymple, and Norgate, not one died. During a period of six years, all the patients lithotomized by Mr. Liston, at University College Hospital, 24 in number, and from two to eighty years of age, recovered. The late Mr. Lynn, of London, cut 25 cases without losing one, and he flattered himself that he had at length discovered the true secret of performing the operation, when, all at once, his good fortune forsook him, and he lost his next four patients. His pride was humbled, and he exclaimed: "The Almighty has punished me for my presumption." I had cut 26 cases before any of them

proved fatal; then, strange to say, I lost three in pretty rapid succession.

The *preparation* of the system must also exert some influence upon the result of the operation. How far this should, as a general rule, be carried, is a point which cannot be easily determined. The subject is one upon which different surgeons will entertain different opinions. I am, myself, always in favor of a certain amount of preparation; but I do not think that it should, in ordinary cases, be carried very far; for the very fact of its employment is often sufficient to inspire the patient with great dread in regard to his ultimate fate. He takes it for granted that an operation which requires so much preliminary attention, must necessarily be one of great danger; and the apprehension thus engendered is well calculated, especially if he be at all timid, to unfit him for the approaching ordeal. Mr. Brett, of Calcutta, who cut 108 persons, with a loss of only 7, is inclined to think that his success was chiefly due to the fact that he always operated without any preparatory treatment, aided by the influence of the mild and salubrious climate of the country, and the simple habits of the natives. Mr. Liston, who lost 16 patients out of 115, or about 1 in $7\frac{1}{2}$, also placed very little reliance upon any measure of this kind; whereas Dr. Dudley, who has lost 1 in $84\frac{1}{2}$, always considers it as of paramount importance. Mr. Martineau always kept his patients a week in the house before they were operated on; he regulated their diet most carefully, but gave them very little medicine. His loss in 84 cases was only 2, or in the ratio of 1 to 42. It is to be lamented that we have no satisfactory statistics upon a subject which every one must regard as of so much consequence.

There can be no doubt that many patients are lost after the operation, even although this may have been executed in the most dexterous and faultless manner, from the want of proper care on the part of the surgeon, or from the imprudence and intractableness of the patients themselves. Children and young persons generally will require very little after-treatment; but elderly subjects always demand the greatest vigilance. The proper rule, however, is to attend to all alike until all danger from the effects of the operation shall have passed over.

What influence, if any, *season* exerts upon the results of this operation is unknown. The only statistics, I believe, upon this subject, are those supplied by Mr. Crosse, and these are on so limited a scale as to entitle them to but little weight. Of 100 fatal cases

of the lateral section, reported by this writer, 6 occurred in January, 3 in February, 11 in March, 11 in April, 9 in May, 9 in June, 5 in July, 6 in August, 9 in September, 9 in October, 13 in November, and 9 in December.

j. Relapse. When it is considered that most vesical concretions have their origin in the kidneys, or, at all events, that these organs are often contemporaneously affected, it is not surprising that the disease should occasionally return after operation. What number of cases relapse after being lithotomized, is a point for the determination of which we have no positive or reliable data. The probability is that the proportion varies not only in private and public practice, but in different institutions and different countries. At the Norwich Hospital there were, according to Mr. Crosse,¹ only 12 cases of relapse after 704 operations, or 1 in 58. At the Luneville Hospital, France, the register shows 13 cases of relapse after 1,492 operations, or 1 in 116. At La Charité, Paris, 70 persons were cut for stone from 1806 to 1831, and in 6 of these, or 1 in 11, the operation was performed a second time. In Bavaria, according to the returns received by Civiale, the proportion of relapses is as 1 to 32; in Bohemia, as 1 to 46; in Dalmatia, as 1 to 53; and in Rumania, as 1 to 16. From the general table, drawn up by this distinguished author and operator, it would seem that the number of persons affected a second time with stone in the bladder after lithotomy, is very small; for, out of 4,446 cases, only 42 relapsed, that is, 1 in 105.²

I have referred to the above statistics, not on account of any intrinsic value which they possess, but because they serve to show what little reliance is to be placed upon such data. If we take the Norwich tables of Mr. Crosse, which are probably as accurate as any that have yet been published, we shall see that only 12 persons out of 704 suffered from relapse after having been lithotomized. Now, who will believe that this is a true representation of the facts of the case? Mr. Crosse states that these individuals were cut a second time, but he does not inform us how many others experienced a return of the disease without having submitted to a second operation. It is perfectly obvious that the history of many of the patients must have been lost, for it may be reasonably inferred that comparatively few revisited the institution in which they had been treated; and, on the other hand, it may be concluded, that

¹ Treatise on the Urinary Calculus, p. 164. 1835.

² Traité de l'Affecton Calculeuse, p. 695. Paris, 1838.

many of those who experienced a relapse either declined further interference altogether, or that, if they sought advice, they went to other operators. Thus, if these premises be correct, it follows, as a natural consequence, that it was utterly impossible to ascertain the number of relapses in the cases to which they relate. The table, therefore, of the English lithotomist, like every similar production hitherto published, is of little practical utility, inasmuch as it is eminently deficient in its details, and therefore only a very remote approximation to the truth.

Relapse after operation is no doubt greatly influenced by the nature of the *calculous diathesis*. There are, unfortunately, no statistics by which the question can be decided; but it is, I think, safe to affirm, that persons affected with phosphatic calculi are more prone to suffer a second and even a third time than those affected with lithic concretions, or concretions composed of urate of ammonia. Organic disease of the kidneys and ureters, the bladder, prostate gland, and urethra, may be mentioned as a predisposing cause of relapse. Derangement of the digestive organs, especially if protracted, and attended with much flatulence and acidity, exercises a similar influence. Indeed, whatever has a tendency to disorder the general health, and depress the vital powers, will be likely to promote the occurrence of the malady, and should, therefore, receive the closest scrutiny, and the promptest attention. Injury of the spine, as from a fall, blow, or kick, especially if followed by paraplegia, will, unless very speedily relieved, be almost sure to be succeeded by relapse.

The *period* at which the relapse occurs must, of course, depend upon circumstances, the nature of which it is frequently impossible even to conjecture, much less to explain. Occasionally it is very short; and, on the other hand, a number of months, and even years, may intervene, the general health, meanwhile, being perhaps little, if at all impaired. As a general rule, it may be assumed that the phosphatic and ammoniaco-magnesian calculi are more rapidly reproduced than the lithic and oxalic. But to this exceptions occasionally occur. Thus, in an instance communicated to me by Dr. J. Dixon, of Alleghany, a man, aged sixty-nine, from whom he removed two large calculi of this kind, experienced a return of his vesical symptoms at the end of three months. He had labored under gravel from an early period, and made a very rapid recovery. A second operation was performed a year after the first, and five similar calculi—two as large as the previous ones—were extracted.

He again made a rapid recovery, and has remained free from urinary disease ever since, now a period of three years.

In two of my own cases, the interval between the operation and the recurrence of the disease was very short; in one it did not exceed four weeks. When this happens, the vesical affection is always, as a general rule, complicated with renal disorder, resulting in the formation of concretions, which gradually descend into the bladder, where their presence is speedily followed by a reproduction of the previous symptoms. This circumstance was strikingly evinced in the instance of Alexander, from whom I extracted two calculi, with only very temporary relief, and whose kidneys, in less than a year after the operation, were literally filled with calculous matter; at the same time that the bladder contained eleven distinct concretions, from the volume of a millet seed to that of a small filbert. In such a case, there evidently exists a calculous diathesis, which no treatment, whatever may be its character, can correct or arrest. It is worthy of notice that the new stone, especially when rapidly formed, is usually very soft and fragile, breaking under the gentlest pressure of the forceps.

The case is quite different when the relapse is occasioned by an imperfect clearance of the bladder. The accident, fortunately infrequent, has happened to good operators, and is not always avoidable, especially when there are several concretions, of which one is extremely small; or when there is only one, and a spiculum, or fragment breaks off, and hides itself, as it were, between the folds of the bladder, or in the *bas-fond* of the viscus. Injection of the viscus with a large syringe and a full stream of water is the best guarantee against this contingency. Should recurrence of the symptoms take place, no time must be lost in ascertaining the real condition of the bladder. If the concretion is small, extrusion is promoted by dilatation of the urethra; if this fail, lithotomy is again employed, and now, if possible, with greater care, to insure future immunity.

The best mode of determining the existence of *fragments* in the bladder after the cicatrization of the wound in lithotomy, is, undoubtedly, the introduction of the sound. The instrument is, of course, used in the same manner as under ordinary circumstances, but great care should be taken that the organ do not contain too much water, otherwise it will not be likely to hit the concretion, or, hitting it, to elicit anything like a satisfactory sound. It is well known that, owing to the retention of fragments, relapse is much more common after lithotripsy than after lithotomy, and an attempt

has recently been made to ascertain the condition of the bladder after the former of these operations, by a careful examination of the urine, which is generally materially altered in cases of this kind. The fluid, according to Mr. Bird, of London, who has paid considerable attention to the subject, is of a pale gummy appearance, of low specific gravity, and pervaded by large organic globules, scarcely distinguishable from pus globules, and exhibiting several nuclei on the addition of acetic acid. Heat does not appear to affect it any; but if liquor of potash be mixed with it in the proportion of one portion to two of urine in a test-tube, the fluid becomes quite transparent, and more or less ropy and gelatinous; so much so, indeed, as to be sometimes poured with difficulty from the vessel in which it is contained. "The differential diagnosis from purulent urine is the absence of albumen, and from mucous urine its gelatinization with liquor potassæ." Mr. Coulson, who has recently called attention to this subject, in a short communication in the *London Lancet*, states that he knew of two cases lately in which the existence of these exudation corpuscles, as revealed by the microscope, eventually led, by persevering efforts, to the detection of stone after the failure of several previous examinations. He lays great stress upon the circumstance, and expresses his conviction that the urine ought to be more frequently examined than it has hitherto been after lithotrity and lithotomy.

k. Repetition of the Operation.—It has been already stated that the operation of lithotomy may, from various causes, require to be repeated, not only once, but perhaps a number of times; and not only so, but, perhaps, in pretty rapid succession. Thus, a case occurred to Dupuytren in which he cut twice in three days. Sir Astley Cooper operated three times in one case, and his nephew, Mr. Bransby Cooper, also, upon another individual, within the space of four years. Dr. Van Buren informs me that Dr. Mott has, on three occasions, operated a second time on the same patient, and that one of the cases had a fatal issue. Dr. Dudley, out of two hundred and seven cases, has had but one, that of a colored boy, twelve years of age, in which he performed a second operation.¹ The late Dr. Nathan Smith,² of New Haven, who had altogether twenty-three cases, was obliged to cut one of his patients three times.

¹ Dr. Bush, MS. letter to the author.

² Medical and Surgical Memoirs, edited by N. R. Smith, M. D., p. 244. Baltimore, 1831.

But the most remarkable instance of this kind upon record is that reported by Mons. Clever de Maldigny, a military surgeon, at a meeting of the French Institute, in May, 1827.¹ In a paper on lithotomy, read before that learned body, he stated that he had been the subject of stone not less than seven times, and that he had six times undergone the lateral operation, namely, at the age of six, eight, eighteen, twenty, twenty-two, and twenty-four years. The sixth time, the stone was situated at the neck of the bladder, and the patient cut himself, a glass being placed between his legs, to enable him to direct the bistoury in the course of the cicatrice of the previous incisions. The calculus was extracted with the fingers. In his seventh attack, he had recourse to lithotrity, which was successfully performed at four sittings, by Dr. Civiale. Subsequently, Clever was operated upon for stone the eighth time.²

A very extraordinary instance in which the operation was performed three times within the space of a few weeks, apparently from neglect to clear the bladder thoroughly of its calculi in the first two, was related to me, many years ago, by Dr. Jameson, formerly of Baltimore, but at the period alluded to professor of surgery at Cincinnati. The subject was Judge Sprigg, of the United States Court, an old gentleman who had been sorely afflicted, for several years, with vesical disease, the true nature of which had for some time escaped detection, notwithstanding the most careful sounding. He was cut first by Dr. Gill, an eminent practitioner of Maryland, who seriously injured the rectum, and removed only a few of the calculi, which, as it appeared afterwards, were quite numerous. A few weeks subsequently he was operated upon by Dr. Physick, of Philadelphia, who took away a wineglassful of calculi. Not being materially benefited, he soon after placed himself under the care of Dr. Jameson, who extracted, besides a number of fragments, not less than forty-nine concretions, many as large as Lima beans, and very much of that shape. Death occurring soon after the last operation, it was ascertained that the cause of the failure of the first two was the existence of an immense pouch in the bas-fond of the bladder, conjoined with great enlargement of the middle lobe of the prostate gland, which had thus prevented the forceps from detecting the calculi in the hands of the other surgeons.

When the perineum has been repeatedly cut for the removal of

¹ *Revue Médicale*, June, 1827; *London Lancet*, vol. xii. p. 556.

² *Lond. Med. and Surg. Journ.*, New Series, vol. v. p. 264.

stone from the bladder, the resulting cicatrice is apt to become preternaturally dense, and to offer more resistance to the knife than the healthy tissues. The part occasionally remains tender for a long time, and in some instances it has been known to be the seat of neuralgic pain. A second operation has often permanently cured a small but intractable fistule left by the first.

VARIETIES IN THE LATERAL OPERATION.

The operation described in the preceding pages is executed, as has been seen, with the knife, and nothing, certainly, could possibly be more simple. It is the very perfection of scientific surgery; the highest point to which, in my judgment, any mechanical process can be carried. Nevertheless, there are some surgeons who prefer to do the operation with the gorget, the lithotôme caché, or the beaked knife, and it will, therefore, be necessary, in concluding this branch of the subject, to offer a few remarks upon each of these instruments. We may also include, under this head, a brief notice of the operation of Pajola, so celebrated for his success as a lithotomist.

a. *Lateral Operation with the Gorget.*—In the preceding pages, an account was given of the lateral section as performed with the knife; a few remarks may now be made respecting the operation as it is executed with the gorget. The gorget is fast falling into desuetude. Whether this is owing to any intrinsic defect in the instrument itself, or merely to the manner of using it, cannot be easily determined. However this may be, very few operators, either in this country or in England, continue to employ it. Dr. Dudley, of Lexington, has performed with it all his operations, upwards of two hundred in number; and I am told that he still uses the same instrument with which he commenced his brilliant career as a lithotomist, forty years ago. Dr. Gibson, of Philadelphia, also adheres to the gorget, and so do a few of the other surgeons of that city. Most American operators, however, prefer the knife, which is also the case in England, France, and other portions of continental Europe. The gorget has undoubtedly committed many blunders, the recital of which would form one of the most sickening chapters in the history of surgical wrongs. Nevertheless, it has done, and still continues to do, good service in the hands of some of our most eminent men, and ought not, therefore, perhaps, to be spoken of too lightly or severely; for its faults are, perhaps, after all, rather attributable

to the surgeon than to the dumb instrument with which he does his bungling work.

The gorget has sometimes slipped into the cellular tissue between the bladder and the rectum, or between this organ and the pubes; thereby bruising and otherwise injuring the parts, and favoring the occurrence of urinary infiltration. Cases are mentioned, where, by a blind and heroic thrust, the instrument completely severed the bladder from its connections, pierced the rectum, or penetrated the peritoneal cavity, and passed high up among the bowels. Mr. John Bell, in his history of lithotomy says: "I have seen the gorget driven twice, not into the bladder, but deep among the bowels; for although there was a stone, the surgeon never reached the bladder. Not one drop of urine followed; the stone was not extracted; and the boy died the second day from the operation." Sir James Earle observes that he has more than once known this instrument, though passed in the right direction, pushed on so far, and with such violence, as to go through the opposite side of the bladder. Mr. Benjamin Bell found in two instances, on dissection, that this organ was wounded in three different parts, at its neck, in its side, and towards its superior fundus. Mr. Crosse states that he has repeatedly seen the gorget slip between the bladder and the rectum; in one instance he declares that the instrument, after entering the bladder, pierced its coats from within outwards, so as to stop against the pubic bone. Bromfield, in passing the gorget, perforated the opposite side of the bladder, and found, to his horror, on withdrawing the instrument, that the intestine had descended through the opening. The bowel had to be held out of the way while he extracted two calculi, though it was forced out again by the child's screaming before he attained his object. "As soon as he was convinced, by his finger, that the bladder was totally free from any pieces of stone, he again returned the intestine into the pelvis, and brought the child's thighs close together; a piece of dry lint was applied to the wound, and a pledget over it; he was then sent to bed with no hopes of his surviving till the next day; but, contrary to expectation, the child had a very good night, and was perfectly well in little more than a fortnight." It is said that the celebrated Scarpa thrust the gorget, which was looked upon as the palladium of his fame, between the bladder and the rectum.

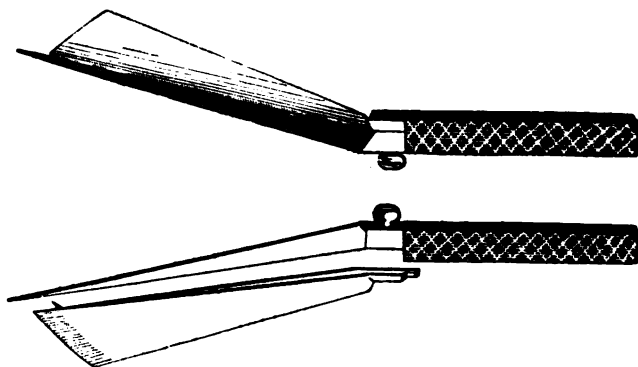
Notwithstanding these misdemeanors of the gorget, and the obloquy which has been cast upon it by different writers, the history of lithotomy shows, as already stated, that it has done good service in the

cause of humanity. Thus, Sir Cæsar Hawkins' operation, as it is termed, which is nothing but the lateral section, executed with the gorget invented by that surgeon, was performed at Paris, in Lombardy, at Lunéville, and at St. Dizier, 513 times with a loss of only 86, or in the ratio of 1 to nearly 6. Excellent as this success is, it has been much more brilliant in the hands of American lithotomists. By a reference to Table I., under the head of statistics of the lateral operation, it will be seen that of the twenty-one surgeons, whose names are therein mentioned, seven operated with the gorget, as modified and improved by Physick, the whole number of cases being 426, of whom 407 were cured, and 19 died, affording a mortality of 1 in 23 $\frac{1}{3}$. Twelve operated with the knife; the number of cases being 424, of whom 22 perished, or 1 in 19 $\frac{1}{4}$. It will thus be perceived that the result is decidedly in favor of the gorget; a fact for which, I must confess, I was not prepared. Notwithstanding this, however, I can see no reason for continuing the use of this instrument; on the contrary, I am decidedly of the opinion that it might be altogether dispensed with. My conviction is that it is just as unnecessary as a fifth wheel in a carriage. Its very appearance is awkward and unseemly; for it looks, to use the language of Mr. Liston, more like a "flaughter-spade," an implement for cutting turf, than an instrument for performing a delicate surgical operation. A light, sharp-pointed scalpel, such as has been described, aided by a well-trained eye and a steady hand, is all that any scientific lithotomist can ever really need. The gorget may do well enough in the hands of an old and expert operator; but in those of the young and inexperienced it must, I am sure, often do mischief.

The operation with the gorget differs, in nowise, in its early stages, from the operation with the knife. The period for using the instrument is immediately after the incision of the membranous portion of the urethra. The surgeon then exchanges the scalpel for the gorget, the beak of which he places in the groove of the staff, guided by the point of the left index-finger. After assuring himself, by drawing the instrument slightly backwards and forwards, that it is in no danger of slipping, he takes hold of the handle of the staff, and by a simultaneous movement of his hands, he lowers the instrument and the gorget nearly to a level with the abdomen; pushing at the same time the latter onward into the bladder. In executing this part of the operation, care should be taken not only that the gorget do not slip out of its place, and thus pass between the rectum and the bladder, but that it is properly lateralized, other-

wise there will be great risk of injury to the rectum and the pudic artery. The annexed engraving represents the gorget, as modified and improved by Physick and Gibson.

Fig. 188.



b. Lateral Operation with the Beaked-knife.—Instead of the gorget, some lithotomists employ a beaked-knife, or a probe-pointed bistoury, for dividing the neck of the bladder and the prostate gland. The beaked-knife of the present day was invented, I believe, by Sir William Blizard, in his time one of the most skilful lithotomists of London. The instrument, which may be either straight, or somewhat concave on its cutting edge, has since been variously modified, but does not differ essentially from the ordinary blunt-pointed bistoury, except that it is a good deal longer in the blade and handle. Many excellent operators, among whom may be enumerated Dr. Mott and Sir Benjamin B. Brodie, still employ this instrument, which I have also used in some of my cases, though of late years I have generally contented myself with the scalpel alone. The beaked-knife is a capital instrument for enlarging the incision, and for dividing the right lobe of the prostate gland, to facilitate the extraction of large calculi. The knife which I generally use, if I use any at all, is represented at p. 550, Fig. 124. I have found it admirably adapted to the purpose.

c. Operation with the Single Lithotome.—This instrument, invented by Frère Côme, is, I believe, seldom employed at the present day. In this country, indeed, I do not think that it has ever been used, except, perhaps, on a few occasions. Pouteau, of Lyons, executed with it all his operations, and his success, as has been already shown, could not possibly have been more brilliant; for out of one

hundred and twenty cases only three died. No instrument ever performed its duty better, or earned more fame for its master.

The lithotôme caché was originally a clumsy instrument, and met with great opposition, in consequence of which it never became much of a favorite with lithotomists. Its inventor used it in operating on both sexes; and there are some surgeons who still occasionally resort to it in the female. The annexed sketch (Fig. 134) represents the lithotôme of Frère Côme, as modified and improved by Mons. Charrière, the celebrated Parisian cutler. It will be observed that it has a single blade, moved by a spring, and concealed in a kind of rod, fixed in a stout handle, and surmounted by a beak, to enable it to slide the more easily and securely in the groove of the staff. The extent to which the blade may be opened is regulated by means of a screw attached to the spring.

The external incisions having been made in the ordinary manner, and the membranous portion of the urethra being fully exposed, the beak of the lithotôme is inserted into the groove of the staff, and passed on into the bladder. The blade is then expanded to the requisite degree, and the division of the deep structures effected in withdrawing the instrument, its edge being directed obliquely downwards and outwards, in the long axis of the prostate gland.

d. Lateral Operation combined with Dilatation.—In connection with this subject may be mentioned the operation of Pajola, a surgeon, who flourished during the latter part of the last and the commencement of the present century. His chief residence was at Venice, but he practised also at Vienna and other cities, where he acquired great celebrity as a lithotomist. It has been said that he cut 500 persons without losing a single one; a statement which is, beyond doubt, entirely erroneous. That he operated very frequently, and with extraordinary success, is highly probable. Rhei-neck, in his *Medicinische und Chirurgische Beobachtungen*, published at Berlin, in 1815, positively asserts that he lithotomized 200 patients with a loss of only 3. The calculi in all the cases were small; for whenever Pajola had reason to suspect that they were at all large,

Fig. 134.



he declined interference, and left the individual to his fate; afraid, no doubt, to jeopard his reputation by the result. His operation was a modification of the process of Le Cat. After having divided the prostate gland to a moderate extent, he dilated the wound by means of a peculiar instrument, upon which he introduced the forceps into the bladder, and then extracted the stone. Pajola thus clearly recognized the force of the axiom, established by Le Cat, and so much insisted upon by many of the best surgeons of the present day; "a large external wound and a small internal one." There can hardly be any question that much of the brilliant success which characterized his career as a lithotomist, was due to the adoption of this rule. A complete account of Pajola's operation was given to the public by Dr. F. X. Rudtorffe, in his *Abhandlung über die Operation des Blasensteins*, published at Leipsic, in 1808.

§ 5.—BILATERAL OPERATION.

The merit of devising this operation is usually ascribed to Celsus, though it more probably belongs to Le Dran. Its advantages have been prominently set forth in modern times by Chaussier, Beclard, and Dupuytren, the latter of whom performed it successfully in 1824, and who may be said to have regularized and perfected it. In this operation, the perineum and the prostate gland are divided on both sides, with less risk, it is asserted, than in the ordinary method, of wounding the pelvic fascia and the surrounding plexus of veins. It is contended, moreover, by the advocates of this plan, first, that it is better adapted to the removal of large calculi; secondly, that it is applicable to all ages and to both sexes; thirdly, that it is singularly easy of execution; and, fourthly, that it secures the rectum, the perineal arteries, and the seminal ducts, from liability to injury. That some of these advantages are exaggerated is sufficiently evident. Thus, as it respects hemorrhage, it is perfectly certain that several patients have perished from it. It is also certain that it is not easier of execution than the lateral section, which is often performed in an almost incredibly short time; nor is it any better adapted to persons of different ages. If it possess any advantages at all over the ordinary method, it must be on the ground that it affords a larger opening for the passage of the foreign body, and that it is attended with less danger to the rectum and the seminal ducts. But even of these the former is, in great degree, counterbalanced by the modern method of dividing the right lobe of the prostate, if the wound in

the left be found insufficient for the extraction of the calculus. In reality, then, the bilateral section has but one advantage over the lateral, namely, the greater immunity which it affords to the bowel and the seminal tubes.

The bilateral operation has sometimes been performed instead of the lateral, on account of difficulty occasioned by malposition of the thigh, which has been known to project so far across the perineum as to diminish the width of this region, and to be seriously in the way of the operator. The deformity may be owing to a congenital vice of the hip-joint, or to ankylosis from disease or accident. In such a case, it may be necessary to approach the bladder through the rectum or the hypogastrium. My friend and former pupil, Dr. Pope, Professor of Surgery in the University of St. Louis, in one instance, not long ago, surmounted the difficulty thus occasioned by the bilateral operation. One hip was ankylosed, and the thigh hung directly in the way of the operator. The stone, which had formed round a piece of necrosed bone, was unusually large, and required to be broken before it could be extracted.¹

Dr. Mott, on one occasion, as he informs me, performed the bilateral section on account of the large size of the calculus, which weighed nearly sixteen ounces and a half. The extraction was effected with immense difficulty, by means of an instrument constructed on the principles of the obstetric forceps, three persons, including the distinguished operator, pulling at the stone, while three others supported the patient, an elderly man, on the table. Death occurred on the fifth day.

The bilateral operation of lithotomy has never had any distinguished advocates in Great Britain, where the ordinary method seems to be universally preferred to all others. Nor has it, so far as I am informed, received much countenance in Germany, Russia, and Italy. It was first performed in this country in 1832, by Dr. Ashmead, of Philadelphia. It was repeated soon after by Dr. Ogier, of Charleston; and within the last fifteen years it has been practised by Stevens, Warren, Mussey, Eve, Parker, Watson, Hoffman, Post, May, Pancoast, Spencer, and other surgeons. It was also, as I am informed, the favorite method of the late Dr. Bushe, of New York. I have myself been so much wedded to the lateral method that I have never felt inclined to employ any other.

The bilateral operation requires the same preliminary measures as

¹ Trans. Amer. Med. Association, vol. iii. p. 377.

the other method. The patient is placed in the same position, the limbs, and the staff are held in the same manner, and the surgeon occupies the same situation. The incisions through

Fig. 135.



the perineum as far as the groove of the staff, are executed with an ordinary scalpel, and the prostate is divided with a double lithotôme caché, a narrow knife, or a probe-pointed bistoury, according to the whim, fancy, or caprice of the lithotomist. The French generally operate with the lithotôme, which is also the favorite instrument of some of the surgeons of this country. Dr. Stevens, of New York, has devised an instrument, named the prostatic bisector, which he uses for cutting the prostate gland and neck of the bladder. An instrument very much on the same plan had been previously contrived by Dr. Pattison and Dr. Bushe. Dr. Mussey, of Cincinnati, formerly employed the lithotôme caché, but of late years, as he has recently informed me, he has given a decided preference to the knife.

The double lithotôme was greatly improved by Dupuytren, and is accurately represented in the annexed drawing (Fig. 135). "It consists of two long, narrow blades, folding upon each other, and concealed in a case, which is slightly curved, and adapted, by its size and shape, to be passed along the groove of the staff into the bladder. Thus, the instrument is introduced through the urethra without injury to the parts, while a mechanical contrivance attached to the handle allows the blades to be expanded after it has been lodged in the bladder. They quit the sheath on each side, and, when separated, resemble the blades of a pair of scissors with the cutting edges reversed. In this state the instrument is withdrawn, and cuts its way out. The size of the opening produced of course depends upon the extent to which the blades have been expanded, their degree of separation being indicated by an index."¹

The operation consists in making a semilunar incision across the perineum, beginning on the right side midway between the tuberosity of the ischium and the margin of the anus, but a little nearer

¹ Brit. and Foreign Med. Rev., vol. ii. p. 101.

the former than the latter, and terminating at the corresponding point of the opposite side, as seen in Fig. 136. The concavity of the

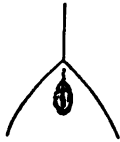
Fig. 136.



cut is directed downwards, and its centre, situated at the raphé of the perineum, is about nine lines above the anus. In this direction are divided successively the skin, the cellulo-adipose tissue, and the superficial fascia, together with a few of the anterior fibres of the external sphincter muscle. The end of the left forefinger is now placed in the bottom of the wound, just as in the ordinary procedure, the staff sought, and the membranous portion of the urethra laid open. The incision in this canal need not exceed four lines. The nail of the finger is then applied to the staff, to serve as a guide to the lithotôme, the beak of which is next inserted into the groove of the instrument, with its concavity looking upwards. Taking care, by moving the lithotôme several times forwards and backwards, that it is securely lodged in the groove, the surgeon seizes the handle of the staff, and depresses it nearly to a level with the abdomen, at the same time that he lowers the lithotôme, and pushes it onward into the bladder. As soon as the instrument has reached the bladder, its point is disengaged from the staff, which is immediately removed. The lithotôme is then turned round with its concavity towards the rectum, and while it is in this position it is withdrawn, its blades being expanded by pressing on their springs. In this manner, it cuts its way out, slowly and steadily, dividing in its retrograde course the sides of the prostate, in a direction obliquely downwards and outwards, as in the ordinary section. The finger now

takes the place of the instrument, the situation of the stone is ascertained, the forceps are introduced, and extraction is effected in the usual manner.

Mr. Fergusson¹, of London, in a case of the bilateral operation in 1843, made an incision in the perineum in the form of an inverted Y, as shown in the annexed drawing, Fig. 137. He fancied that by extending the cut some distance up the raphé, towards the scrotum, the wound would admit of greater expansion than the semicircular one of Dupuytren, and that it would thus afford increased facilities for the extraction of the foreign body. Such a direction might, perhaps, be proper in cases of unusually large calculi, but would hardly be under ordinary circumstances.



No statistics have yet been furnished, on an enlarged and reliable scale, of the results of the bilateral operation. In the posthumous work of Dupuytren,² who introduced this method into France, and who imparted to it much of its present perfection, is a table comprising the results of 89 cases, of which 19 terminated fatally, making an average mortality of 1 in 4½. It is proper to add that four of the cases occurred in females, who all recovered. Seven of the patients perished from inflammation of the bladder and cellular tissue, as a direct effect of the operation; four, from difficulties connected with the perineum and the size of the stone; two, from hemorrhage; one, from laceration of the prostate; one, from cancer of the bladder; one, from gastro-enteritis; one, from spasm and delirium; one, from retention of several concretions in an abnormal pouch of the bladder; and one, from calculous disease of the prostate.

It was not without trouble that I succeeded in collecting the subjoined statistics in relation to the bilateral section, as performed by some of our own surgeons. The facts, although meagre, are not without interest in a practical point of view. Added to those of Dupuytren, they afford a tolerably correct view of the mortality of the operation.

¹ *Practical Surgery*, p. 606. Phila. 1853.

² *Mémoire sur l'Opération de la Pierre*, par Sanson and Bégin, p. 32, Paris, 1836.

Table showing the Results of 118 Cases of the Bilateral Operation, in the practice of American Surgeons.

Operators.	Cases.	Instrument.	Cures.	Deaths.	Proportion.
R. M. Mussey	83	Knife,	80	3 ¹	1 in 11
P. C. Spencer	24	Lithotôme,	22	2	1 in 12
P. F. Eve	23	Lithotôme,	19	4 ²	1 in 5½
Willard Parker	16	Knife,	18	8	1 in 5½
A. H. Stevens	12	Knife & bisector,	12	0	
T. L. Ogier	8	Lithotôme,	8	0	
J. F. May	8	Lithotôme,	2	1	1 in 8
W. T. Briggs	4	Lithotôme,	4	0	
Total	118		108	18	1 in 9⅓

If to the American cases, we add those of Dupuytren, above given, we shall have an aggregate of 207 cases, with 32 deaths, or a loss of 1 in 6½.

§ 6.—QUADRILATERAL OPERATION.

Nothing need be said here of the quadrilateral operation of lithotomy, devised by Mons. Vidal, of Paris,¹ beyond the fact that it is one of those singular novelties of which there seems to be so much fondness among French surgeons. It was first formally announced by this distinguished gentleman in his inaugural dissertation in 1828, although he had performed it upon the dead subject several years previously. The first essays with it upon the living subject were made by Velpeau and the younger Guersant, of Paris. It has since been performed with several successful results by Goyrand, of Aix, Rolland, of Toulouse, and Roux, of Toulon. The operation consists

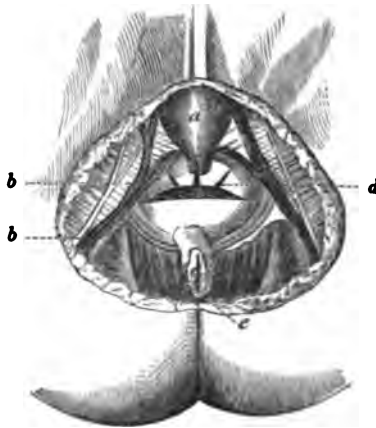
¹ Dr. Mussey informs me that these cases were by far the most unpromising of the forty-eight which he has cut by the lateral and bilateral methods, and that he had scarcely any hope of success when they were subjected to the operation. He has employed the knife in a majority of his cases. The one which he at present uses, both for the superficial and deep incisions, is scalpel-shaped, the blade being from three to five lines broad, and the point sufficiently narrow to be easily inserted into the groove of the staff.

² Death in one of Dr. Eve's cases was caused by epidemic dysentery after the wound was nearly healed; the patient was ten years old, and the stone weighed upwards of three ounces. In the second case, the patient, a man, aged seventy-seven, died from the effects of the operation at the end of sixty hours; the prostate was much enlarged, and the bladder was sacculated. The two other cases perished from erysipelas; one on the sixth day, and the other about the twelfth.—*Amer. Journal of the Med. Sciences*, vol. xxiv. p. 41, 1852.

³ *Traité de Pathol. Externe*, t. v. p. 271. Paris, 1846.

in incising the prostate at four different points, the first incision being made transversely, as in the bilateral method of Dupuytren. If the calculus be very large, the two inferior cuts are directed obliquely downwards and outwards, and the two superior obliquely upwards and outwards, as in the annexed drawing, Fig. 138. The

Fig. 138.



a. Bulb of the urethra, below which is seen an internal vertical incision. b, b'. The arteries and veins of the perineum. c. A semilunar transverse incision dividing the prostate. d. An ascending incision, which is repeated on the opposite side. e. The anus.

advantage in favor of this operation is that the wounds thus made admit of the more easy extraction of large calculi; to which the procedure is restricted. Whether this advantage is not more than counterbalanced by the ill effects which must result from such extensive hacking of the gland, is a point concerning which every lithotomist is as competent to judge as I am myself. There is no probability that the operation will attract serious attention anywhere, much less that it will be frequently performed.

§ 7.—MEDIAN OPERATION.

Attention has recently been directed to this operation by Professor Rizzoli,¹ of Italy, who, at the date of his publication, had performed it eight times, and in every instance successfully. As the name implies, it consists in opening the bladder at the raphé of the perineum,

¹ *Bulletino delle Sc. Med.* t. xvii. p. 271; *Brit. and Foreign Medico-Chir. Rev.* vol. viii. p. 270, 1851.

which, as a preliminary step, is rendered as prominent as possible by means of a curved staff. The first incision is begun a few lines below the base of the scrotum, and carried as far back as the margin of the anus. Placing the point of the left index-finger into the upper part of the wound, under the bulb of the urethra, in order to protect it, the surgeon feels for the groove of the staff, and penetrates the membranous portion of the tube; but previously to dividing it he takes the instrument from the assistant, and brings the handle to a right angle with the pubes. The object of this manœuvre is to render the membranous portion prominent, and facilitate its division without detriment to the rectum. The knife is then carried forward to the prostate gland, the edge of which is partially divided, thus lessening the risk of urinary infiltration. The incisions being completed, the index-finger is passed, with its palmar surface upwards, into the bladder; the staff is withdrawn, the forceps are introduced, and the stone is seized and extracted in the usual manner. If the concretion be very large, it should be broken, and extracted piecemeal; a procedure which is much better than the attempt to remove it entire, as this might unduly bruise and lacerate the soft parts.

The advantages claimed for this operation by Professor Rizzoli, are, first, that it is free from hemorrhage; and, secondly, that it does not inflict any injury upon the bladder, rectum, and seminal ducts, as happens in some of the other methods. Whether these advantages are well founded is a circumstance which future observation alone can determine; as yet, the operation has not been performed sufficiently often to justify us in expressing a definite opinion respecting it. It is not difficult, however, to conceive that it might answer admirably in cases of small calculi, while it might be very objectionable in large ones, on account of the inadequacy of the wound made by it.

§ 8.—RECTO-VESICAL OPERATION.

The recto-vesical operation, devised in 1816, by Sanson, of Paris, is already obsolete.¹ When first introduced to the notice of surgeons, it was invested with a sort of *éclat*, on account of its supposed advantages, of which not the least striking is its apparent simplicity, and the facility with which it may be executed. It was also imagined that it was entirely free from the risk of hemorrhage, and that, from

the dependent character of the wound, it admitted of the more easy extraction of the foreign body. Like all professional novelties, it was embraced by some, and denounced by others. Time progressed; the operation was tried, and found wanting. Experience showed that it was often succeeded by extensive suppuration of the cellular tissue within the pelvis, thus endangering both part and system; that the ejaculatory ducts, and even the seminal vesicles, were occasionally wounded; and lastly, though not least, that it was liable to leave a fistulous communication between the bladder and the rectum. These disadvantages are more than counterbalanced by any benefits which it was supposed to possess by Sanson and his followers. It is not surprising, therefore, that it should soon have fallen into disuse.

Two modes of operating were at one time in vogue, differing from each other chiefly in the relative extent of the incisions. In one, known as Vacca's method, the membranous portion of the urethra is opened in front of the anus, directly in the middle line, with an ordinary scalpel. As soon as the staff, held as in the lateral operation, is fairly exposed, a probe-pointed bistoury is inserted into it, and carried into the bladder, dividing in its progress the inferior part of the body of the prostate, with a small portion of the anterior wall of the rectum.

In Sanson's operation, the only difference is, that the incision is carried somewhat higher up. In the original operation by this surgeon, the rectum was divided to the extent of only an inch and a half, whereas, in this, it is at least from six to eight lines longer. When prolonged beyond the posterior margin of the prostate, as it is in Sanson's operation, the incision is liable to penetrate the peritoneum; an accident which has several times occurred in practice.

Although the recto-vesical section has been discarded, as one of the regular operations of lithotomy, circumstances may arise which may render it not only justifiable but highly proper. Thus, the stone may be lodged in the bas-fond of the bladder, or it may be impacted in one of the ureters, or, finally, it may bulge into the rectum, forming a tumor from two to three inches above the verge of the anus. In such a case, the foreign body would be more accessible by the recto-vesical than the perineal incision.

Table showing the Results of 83 Cases of the Recto-Vesical Operation.¹

Operator.	Method.	Cases.	Cures.	Fistule.	Deaths.	Proportion.
Vacca	Second	24	19	2	5	1 in 4 $\frac{1}{2}$
Giorgi	1 & 2	10	10	1	0	
Cavarra	Second	10	9	1	1	1 in 10
Janson	First	7	4	0	3	1 in 2 $\frac{1}{2}$
Cittadini	Second	5	4	2	1	1 in 5
Dupuytren	First	4	3	2	1	1 in 4
Moschi	Second	3	3	0	0	
Different operators	First	8	5	1	3	1 in 2 $\frac{1}{2}$
	Second	9	7	1	2	1 in 4 $\frac{1}{2}$
	1 & 2	3	3	1	0	
		83	67	11 ²	16	1 in 5 $\frac{1}{2}$

It is much to be regretted that our information respecting the mortality of the recto-vesical operation is so very limited and unsatisfactory. Mons. Velpeau, twelve years ago, summed up our knowledge upon the subject in the following language: "Finally, out of about one hundred operations of this kind, performed up to the present time, by Sanson, Dupuytren, Camoin, Pezerat, Willaume, Cazenave, Dumont, Castara, Urbain, Janson, Taxil, Barbantini, Vacca, Géri, Orlandi, Gallori, Mansfredi, Guidetti, Farnèse, Giorgi, Giuseppe, Cittadini, Mori, Lancisi, Castaldi, Cavarra, Regnoli, Bandlera, Heihg, Fasoti, Meli, Clot-Bey, Wenzel, Dawson, Lallemand, and Lafosse, we count about twenty deaths, the same number of fistules, and a variety of accidents which endangered the lives of some of the patients."

§ 9.—URETHROTOMY; OR, INCISION OF THE URETHRA, WITH DILATATION OF THE NECK OF THE BLADDER AND THE PROSTATE GLAND.

Under this head may be briefly described two operations, which consist, as the name implies, in incising the urethra, and then dilating the opening to an extent sufficient for the easy extraction of the foreign body. In one, that of Dr. de Borsa, the expansion is effected rapidly, with the finger; in the other, to which the term lithectasy has been applied, slowly, and with particular instruments.

a. Operation of Dr. de Borsa.—I am induced to notice this process on account of the alleged facility of its execution, its great simpli-

¹ Journal der Chirurgie von Graefte und Walther, B. 8, S. 540.

² These cases are added to the cures, or, rather, recoveries, only 56 of which were complete.

city, and the remarkable success which is said to have attended it in the hands of its inventor. It appears to be merely a modification of the process of Signor Manzoni, of Verona, of which that surgeon published a description in 1808; and the author declares that of one hundred patients cut by that practitioner and himself, only one died, and he not from any causes connected with the operation.

The patient is placed in the ordinary position, but instead of being confined by ligatures he is held by assistants. The only instruments required are a staff, a bistoury, and a pair of forceps. Having made an incision along the raphé of the perineum, Dr. de Borsa opens the whole of the membranous portion of the urethra, so as to expose the staff to the extent of about ten lines; when, laying aside his knife, he at once passes the left index-finger into the bladder, along the right side of the instrument, and then, by a semi-rotatory movement of the member gently and cautiously conducted, he dilates the prostatic portion of the urethra and the neck of the bladder sufficiently to enable him to introduce the forceps and extract the calculus. The operation is free from hemorrhage, as well as from the danger of urinary infiltration, and is executed with astonishing rapidity, a minute usually sufficing for its completion.¹ It is applicable only to cases of small calculi, and has not, so far as I know, ever been performed in this country.

b. Lithectasy.—Lithectasy, as it has been termed, is merely a modification of the operation of Manzoni and de Borsa just described. It consists in making an opening into the urethra through the perineum, smaller than in ordinary lithotomy, and in slowly dilating the neck of the bladder until the aperture is sufficiently capacious to admit of the passage of the foreign body. The expedient is a modern invention, having been first employed by Sir Astley Cooper in 1819, at the suggestion of Dr. Arnott, of London. The recent revival of it is due to Dr. Willis, an English surgeon. I am not aware that it has been adopted by any American lithotomists.

The position of the patient and of the staff is the same as in the ordinary method. The incision, about an inch and a half in length, extends along the raphé of the perineum to within about six lines of the margin of the anus. As soon as the staff is felt at the bottom of the wound, the membranous portion of the urethra is freely divided over it, after which the operation is completed with an Arnott's dilator. This consists of a cylindrical bag of oiled silk,

¹ *Medico-Chir. Review*, April, 1846, p. 360.

which is carefully insinuated into the bladder along the groove of the instrument, and is injected with tepid water until the patient begins to complain of uneasiness. The distension is increased at short intervals, not forcibly and suddenly, lest it produce pain and other mischief, but gently and slowly, without fretting or irritating the parts. The dilatation is generally sufficiently advanced, in thirty or forty hours, to enable the surgeon to introduce the forceps and extract the calculus.

It is difficult to conceive what advantage such a proceeding possesses over the ordinary operation. I must confess it does not impress me at all favorably. Even supposing that the dilatation is not productive of much pain, it is not difficult to imagine that it might be followed by erysipelas of the perineum, and severe inflammation of the neck of the bladder. Of the few cases in which lithectasy has been practised, the results are by no means flattering. Besides, an operation attended with so much delay must necessarily create a good deal of apprehension in the patient, especially if he is nervous or timid, in regard to his ultimate safety; and, in the last place, the foreign body, unless exceedingly diminutive, is not likely to pass through so small a wound without great difficulty, and without inflicting undue violence upon the surrounding parts. If I were myself affected with calculus, and were compelled to choose between lithectasy and the ordinary procedure, I should certainly give my decision in favor of the latter, both on account of its greater expedition, its greater freedom from pain and mental anxiety, and, as I believe, also its greater safety.

§ 10.—SUPRA-PUBIC OPERATION.

In the supra-pubic, or high operation, as it is commonly called, the bladder is opened above the pubes, in the direction of the linea alba. The proceeding, although objectionable as a general rule, may occasionally be resorted to with advantage, and, therefore, requires brief consideration in this place. The operation has not been often performed in this country. Professor Gibson, of Philadelphia, was the first to employ it, in the case of an old gentleman of Virginia, who was affected with great enlargement of the prostate gland, and who died soon after from the effects of peritonitis, consequent upon urinary effusion. Dr. Carpenter, of Lancaster, Pennsylvania, repeated the operation soon after with a more fortunate result. A short time before I entered upon my professional studies with the

late Dr. George McClellan, of Philadelphia, that gentleman performed the operation; but his patient, whose constitution had been much shattered by previous suffering, did not long survive it. Subsequently he repeated the operation, not less, certainly, than five times, with very gratifying success. Within the last twenty years, supra-pubic cystotomy has been employed, with various results, by different American practitioners; none of whom, so far as my knowledge extends, are disposed to give it a preference over the lateral method. In Europe, the great modern champion of this operation is Dr. Souberbielle, of Paris, whose experience with it is much greater, and, therefore, entitled to more confidence, than that of any other modern surgeon. From a paper, inserted in the eighth volume of the *Mémoires de l'Académie Royale de Médecine*, it appears that he performed the operation thirty-nine times, between the years 1828 and 1834, and that with an amount of success so flattering that he is inclined to prefer it to every other procedure. In England, the operation excited a good deal of attention, first, in the time of Douglas, Cheselden, Pye, and Thornhill, all of whom repeatedly performed it; and, subsequently, in consequence chiefly of the writings of Mr. Carpue,¹ who witnessed a number of Dr. Souberbielle's cases, and who took great pains, after his return from France, to attract to it the notice of the British profession. The originator of the operation was Franco.

The chief advantages of the high operation are, that it is free from hemorrhage; that it does not expose the patient to injury of the rectum and the ejaculatory ducts; that there is no risk from inflammation of the neck of the bladder; that it may be performed where the lateral section is impracticable, on account of impassable stricture of the urethra, excessive depth of the perineum, deformity of the pelvis, or great enlargement of the prostate gland; and, lastly, that it admits of the more easy removal of a large, attached, or encysted calculus. As an offset to these advantages, it is to be remarked that the procedure is liable to be followed by injury of the peritoneum and by urinary infiltration, not to say anything of the difficulty of executing it when the abdomen is loaded with fat, or the bladder does not ascend any distance above the pubes. The latter of these dangers may, however, in general, be avoided by premising a perineal puncture, to serve as an outlet to the urine, which thus drains off as fast as it reaches the neck of the bladder.

¹ A History of the High Operation for the Stone. London, 1819.

The former, too, may usually be guarded against, if the precaution be used, first, to distend the bladder thoroughly before the operation, and, secondly, to push the peritoneum gently before the knife after cutting through the inferior part of the linea alba.

In performing the operation, the patient is placed recumbent, upon a narrow table, with the legs hanging loosely over its lower edge, and the feet resting upon a chair. The head and shoulders are somewhat elevated by pillows, to relax the abdominal muscles. Any hair that may cover the supra-pubic region is to be removed with the razor or scalpel. The bladder, if not previously distended by the retention of its own contents, is now filled with tepid water until it rises a considerable distance above the pubes. Trifling as this part of the operation apparently is, it cannot be performed with too much care, to prevent the rupture of the organ; an accident which happened occasionally in the hands of the older lithotomists.

These preliminaries being duly attended to, the surgeon, standing on the left side of the patient, makes an incision from three and a half to four inches in length, commencing at the pubic symphysis, and extending upwards towards the umbilicus, in the direction of the linea alba. It should pass through the skin and cellulo-adipose substance, down to the aponeuroses of the abdominal muscles. These structures, being thus exposed, are next cautiously divided to the same extent. Any vessels that may bleed are now secured; or, what will usually answer equally well, compressed by the finger of an assistant. The bladder will now be found at the bottom of the wound, forming a tolerably large, fluctuating tumor, and invested merely by a thin layer of cellular tissue. To divide this, a few gentle touches of the knife are sufficient; or, what is better and more safe, the dissection may be effected with the rounded steel end of the handle of the instrument. Conducted in this manner, there is hardly any possibility of wounding the peritoneum, the great danger in this stage of the operation. If the bladder is quite prominent, it should now be transfixed by a delicate tenaculum; otherwise it should be rendered sufficiently so by the introduction of a sound through the urethra. In either case, it is, I conceive, a matter of paramount importance to secure the bladder before it is incised, in order to prevent it from collapsing, and sinking down behind the pubic bones; an occurrence which cannot fail greatly to embarrass the subsequent steps of the operation. A puncture is next made into the anterior surface of the viscus, on a level with the pubic symphysis, large enough to admit the index-finger of the left hand,

which is at once introduced, and used as a searcher to ascertain the situation and volume of the stone. The opening is afterwards enlarged, with a probe-pointed bistoury, to any extent that may be required; the forceps are introduced; and the stone is seized and removed. A short silver tube, carefully rounded at the end, and pierced with numerous apertures at the sides, is now introduced into the bladder, at the lower part of the wound, and secured by two pieces of tape, fastened to a broad roller; the edges of the remainder of the wound being previously approximated by several points of the *twisted suture*, aided by adhesive strips. Instead of a tube, a slip of linen may be inserted into the bladder, for conducting away the urine. This it does on the principle of a siphon.

Such is the ordinary mode of proceeding. For the sake of greater safety, as it respects infiltration, it has been proposed to cut into the membranous portion of the urethra, on the left side of the perineum, making an opening barely large enough to admit of the ready introduction and lodgement of a common lithotomy tube, to afford the urine an opportunity of passing off as soon as it reaches the bladder. In this case, the whole of the supra-pubic wound is accurately closed immediately after the extraction of the calculus, to insure union by the first intention.

Souberbielle introduces a siphon catheter into the urethra as soon as the operation is over, and retains it there until the wound is healed, which it generally is in from fifteen to twenty days. When the instrument becomes a source of irritation to the bladder, it is removed, and the water is permitted to escape, either partially or wholly, by the wound. He also opens the bladder by a *sonde-a-dard*, introduced by the urethra, and brought out through the *lines alba*, above the pubes.

Much of the danger of urinary infiltration after this operation might be prevented, it seems to me, by the use of a self-retaining catheter, such as that recommended by Dr. Sims in the treatment of vesico-vaginal fistule. The urine would thus be conducted off as fast as it reaches the bladder, and the escape of it at the supra-pubic wound would be impossible, especially if the patient take care to lie on the back until the opening in the bladder is united.

Professor Parker, who has performed this operation three times, and in every instance successfully, executes it in the following manner: 1. Having administered chloroform, he fills the bladder with water and requests an assistant to prevent the fluid from passing off by applying the finger to the orifice of the urethra. 2. He exposes

the bladder in the usual manner. 3. A tenaculum is inserted into the bladder on each side of the middle line, and the organ divided between the two instruments. 4. The forceps are introduced and the stone extracted. 5. The pressure is removed from the urethra, to let off the water, and permit the contraction of the bladder. It would be difficult to conceive of a more simple and elegant method of performing such an operation.

Although the high operation is generally exempt from hemorrhage, yet a case is mentioned in which Pye, an English lithotomist, is said to have lost his patient from this cause. The probability is that the blood, in this instance, came from an anomalous artery or an irregular distribution of the circumflex iliae.¹ In a case operated upon by Thornhill there was also considerable, though not fatal, bleeding.² When such an occurrence takes place, the bleeding vessel should be searched for, and secured with the ligature. If the blood issues at numerous points, as it may when there is a hemorrhagic diathesis, the tampon should be employed; and the same treatment will be likely to prove beneficial when the fluid proceeds from a vessel of the bladder.

It has been seen that the chief danger of this operation is injury of the peritoneum. When this is followed by the admission of urine, even in the smallest possible quantity, into the general cavity of the abdomen, violent inflammation is sure to ensue, and to destroy the patient in a few days. Mere lesion of the membrane, without extravasation, is, on the contrary, comparatively harmless. That this is the fact is amply proved by the results of the operations of Frère Côme, Thornhill, Douglas, Crozat, Léonardon, and others, who all committed this error without any serious detriment to their patients.

When abscesses form in consequence of an escape of the urine into the connecting cellular tissue round the wound, early and free incisions are made, followed by the warm-water dressings. If the matter be allowed to remain pent up, serious mischief must result from its tendency to burrow, and irritate the peritoneum.

The following table, comprising all the authentic facts which I have been able to obtain, will serve to afford some idea of the mortality of

¹ "In the old method of performing this operation, hemorrhage," says Carpue, "must be common, as I have been sent for to examine three persons who died shortly after the operation, and who, on inspection, I found had died from hemorrhage, from the puncture of a branch of the circumflexus ilii, which anastomosed with the epigastrie."—*History of the High Operation*, p. 151.

² *Traité de la Cystotomie Sus-Pubienne*; par Denis Belmas, p. 267. Paris, 1827.

the high operation. It will be noticed that it is founded exclusively upon the results of French and English lithotomists. So far as I am aware, the proceeding has never been in vogue in Scotland and Ireland, or on the continent of Europe generally. In this country, as already stated, it has never been regarded with much favor:—

Table showing the Results of 180 Cases of the Supra-Pubic Operation.

Operators.	Cases.	Cures.	Deaths.	Proportion.
Frère Côme	100	81	19	1 in 5 $\frac{1}{5}$
Douglas	4	3	1	1 in 4
Cheselden	9	8	1	1 in 9
Paul	4	4	0	0 in 4
Pye	4	1	3	3 in 4
Malgill	4	3	1	1 in 4
Thornhill	16	13	3	1 in 5 $\frac{1}{3}$
Souberbielle	89	28	11	1 in 3 $\frac{4}{5}$
\	180	141	39	1 in 4 $\frac{1}{3}$

Of Frère Côme's¹ patients, 59 were females, and 51 were males; of the former, 9 died, and of the latter, 10; a result showing that women bore the operation better than men. In Souberbielle's cases, the sex is not stated. It is worthy of remark that many of his patients were advanced in years, that several of them had been previously subjected to lithotripsy, that ten were unusually fat, that a number labored under hernia, that one had nearly three hundred calculi, and, finally, that in a few the calculi were encysted. In stone in children, Souberbielle prefers the lateral section.

Dr. George McClellan, as previously stated, performed the supra-pubic section at least five times. He was a warm advocate for the procedure under certain circumstances. His first case terminated fatally, owing to organic disease of the bladder and prostate, although the man lived some time after the operation. The next three patients recovered; of the other case the result is not known.²

Professor Parker, as he has recently informed me, has opened the bladder three times above the pubes for the removal of calculi. All his patients were females, their ages varying from forty-seven to fifty-four; and all made a very satisfactory recovery.

¹ *Traité de la Taille*, Paris, 1779; Pascal Baseilhac, *Traité sur la Lithotomie*, p. 332, Paris, 1804.

² MS. Letter of Dr. J. H. B. McClellan, Sept. 1854.

A very remarkable case of supra-pubic lithotomy, and one that deserves to be reproduced here, occurred in 1837, in the practice of Professor Uytterhoeven,¹ Surgeon to St. John's Hospital, Brussels. The following is an outline of its more important features:—

CASE.—A man, aged thirty-nine, a native and resident of Brussels, had labored under vesical disease nearly twenty-seven years, when he was lithotomized. He survived the operation eight days. The calculus, which weighed upwards of two pounds, was of a gourd-like figure, and was accurately moulded to the shape of the inside of the bladder, being nearly seven inches in length, upwards of four inches in breadth at the broadest part, and nearly two inches and a half in thickness. It had a rough, tuberculated surface, and appeared to consist of a number of thin, friable lamellæ. The walls of the bladder were indurated, and an inch thick, except at the point corresponding with the summit of the concretion, where they were completely worn down to the peritoneal coat. They contained several purulent dépôts and fistulous passages. An immense abscess occupied the left iliac fossa. The small intestines and the mesentery were highly inflamed.

§ 11.—INGUINAL, SCROTAL, AND LABIAL LITHOTOMY.

In the chapter on Cystocele, as well as in other portions of this treatise, mention is made of the fact that urinary calculi are occasionally situated on the outside of the pelvic cavity, being either developed there, or carried thither by the prolapsed bladder. The occurrence, although not frequent, is worthy of particular attention, as it involves important principles of treatment. The most common site of the foreign body is the groin, but in some instances the concretion descends into the scrotum, the ischiatic notch, or the pudendum, forming, either by itself, or along with the bowel, a considerable-sized tumor, of a firm consistence, or soft at one point, and hard at another. Occasionally the substance is lodged partly within the pelvis and partly without; and it should be remembered, moreover, that there is sometimes a number of calculi, as in the famous case of Ruysch,² in which there were not less than forty-two, and in the still more remarkable one recorded by Mr. Paget,³ of Leicester, England, and described on p. 640.

The *symptoms* of this form of calculus do not differ materially from those which attend the ordinary affection. The patient is tormented with pain in the bladder and a frequent desire to pass his

¹ Archives de la Médecine Belge, t. i. p. 19, 1840.

² Obs. Anatom. Chir. Obs. i. p. 1, 1691.

³ London Med. and Physical Journal, vol. vi. p. 391, 1801.

water, which is often evacuated with great difficulty and only after much straining. Sounding affords little or no light, except of a negative character, or where the calculus is lodged partly in the pelvis, when it may sometimes be touched by the instrument, and thus furnish the usual evidences of the presence of a foreign body. It deserves to be remembered that, where a number of concretions exist, some may lie loose in the body of the bladder, while the rest are lodged in the prolapsed portion of the organ. Such a case, in which two operations were performed before complete riddance was effected, is related in the fourteenth volume of the *Edinburgh Medical and Surgical Journal*, and is of great interest in its practical relations. In general, the stone, when situated externally, can be detected only by the touch; when several concretions are present, a distinct crackling noise may occasionally be elicited by rubbing them against each other.

The proper *treatment*, in all cases of extra-pelvic calculi, is to make an incision through the coats of the prolapsed portion of the bladder, as it lies in its abnormal situation, to extract the foreign body with the fingers, scoop, or forceps, and to retain a catheter in the organ until the wound is thoroughly cicatrized, lest the parts should suffer from urinary infiltration. Such an operation is not dangerous, because the tumor in its descent does not drag down the peritoneum, and there is, therefore, no proper hernial sac. It is only when the case is complicated with enterocele that there is likely to be a serous investment, although this need not necessarily be divided even then. When the concretion projects into the pelvis by its larger extremity, the lateral, bilateral, or supra-pubic operation may become necessary, as complete riddance, under such circumstances, is hardly to be expected by external incision. Several examples have been reported by authors of the spontaneous discharge of vesical calculi from the groin.

The following cases are appended as illustrations of the nature, symptoms, and treatment of extra-pelvic calculi of the urinary bladder:—

CASE 1.—A man, whose case is related by J. D. Sala,¹ was tortured for a long time with symptoms of stone, which eluded all attempts at detection. Sounding, the introduction of the finger into the anus, and every other mode of exploration proved alike unavailing. The patient at length died, and, on dissection, the calculus was found in a portion of the bladder which had descended into the scrotum. An intestinal hernia existed on the other side.

¹ Thomas Bartholin, *Hist. Anat. Cent. IV. hist. 28.*

CASE 2.—The elder Petit¹ was consulted by a man, aged forty-seven, on account of a painful tumor on the right side of the scrotum, which always became distended when he attempted to pass his water, which, at such times, issued only in drops. On lifting up the scrotum, however, and compressing it with the hand, the urine always flowed in a full stream. He also micturated with comparative facility, and without the aid of pressure, when he lay on his back, and raised his loins. In the morning, and at all other periods when the fluid was retained unusually long, the operation was performed with more difficulty, being invariably accompanied by pain and straining. The man also declared that he had felt several round stones in the scrotal tumor, which had easily repassed into the bladder, and been afterwards discharged by the urethra.

CASE 3.²—A boy, aged six years, was seized with acute pain about the pubic region and an inability to void his urine; his suffering lasted nearly an hour and a half, when he became quite easy, and was able to empty his bladder. In a few days a tumor, about the size of a pea, was noticed in the spermatic cord, just below the groin; this gradually increased in volume, and at the same time descended lower and lower, until at length it reached the bottom of the scrotum. During all this time there was a frequent desire to urinate, but no pain or difficulty in accomplishing the act. At the age of thirteen the boy was placed under the care of Mr. Pott, of London, who, finding the swelling of a hard, incompressible, and indolent character, supposed it was nothing but a diseased testicle, which he accordingly attempted to excise. On laying open the parts, he came in contact with a firm, white cyst, surrounded by cellular tissue, and terminating above in a membranous duct, not unlike one of the ureters. On tracing this duct upwards into the groin, it was seen to issue from the external abdominal ring, being intimately connected with the spermatic cord; and, on dividing it, there escaped from it about four ounces of a clear fluid, evidently urinous in its character. The cyst was now fully exposed, and was found to contain a calculus, exactly similar to those formed in the bladder. The testicle lay immediately behind the body of the tumor, and was small, flat, and compressed. The urine was discharged through the groin for about a fortnight, but as the wound healed it resumed its natural course, and the lad recovered without an untoward symptom.

CASE 4.—A woman, aged seventy years, attended by Tolet,³ had an inveterate descent of the uterus, which formed a tumor on the outside of the vulva of the volume of a small melon. She had frequent desire to make water, and great pain in discharging it. The tumor, on being handled, emitted a crackling noise, which induced the belief that the bladder had descended with the womb, and that it contained several calculi. A longitudinal incision being made into the part, at the place where the stones were easily felt, no difficulty was experienced in extracting them, the largest weighing half an ounce, and the smallest being as big as a filbert. The tumor was afterwards reduced, and retained by pessaries, secured by a T bandage. Tolet adds that the woman was well in eight days.

In the case recorded by Ruysch,⁴ in which the cystocele was also accompanied by prolapsus of the uterus, that celebrated anatomist and surgeon removed forty-two calculi, and succeeded in relieving his patient, who was eighty years of age. Duver-

¹ M. Verdier, *Mém. de l'Acad. de Chir. de Paris*, t. ii. p. 18.

² Pott's *Chirurgical Works*, vol. i. p. 484. Phila. 1819.

³ *Traité de la Lithotomie*, p. 276.

⁴ *Obs. Anat. Chir. Obs. i. p. 1*, 1691.

ney¹ gives an instance in which the bladder, uterus, and vagina were all prolapsed simultaneously, and in which the calculus was uncommonly large.

CASE 5.—Hartmann,² an old German author, met with an instance in which the prolapsed bladder formed a distinct tumor in the perineum, the skin of which was so exceedingly thin that the calculus could be readily seen through it. The concretion weighed three ounces, and lay in a cul-de-sac between the vagina and the rectum.

CASE 6.³—Margaret Peat, aged forty-seven, a married female, without children, had been affected for about nine years with a tumor at the pudenda, supposed to be merely a prolapsed womb. At the time of her admission into the Infirmary at Leicester, the tumor was as large as the head of a new-born infant, very sore, inflamed, excoriated, and heavy, with a sensation, on being handled, as if there were a fluid near the surface and a harder substance within. It extended from the urinary meatus to the extremity of the rectum, which was pressed forcibly against the coccyx, its longest diameter being about eight inches. It was entirely irreducible, and the uterus, the orifice of which was distinctly visible on the slightest inspection, was situated at its inferior part. She labored under severe pain, attended with tenesmus and prolapse of the bowel, which greatly augmented her suffering. The urine was highly purulent, and always voided in small quantity. All attempts to pass the catheter failed, and the various medicines that were tried afforded her no relief. She expired about five weeks after her admission.

The chief bulk of the tumor was composed of the bladder, which was reflected backwards, and covered by the vagina in a state of inversion. The organ was much diseased, its coats being nearly an inch in thickness; and its cavity was occupied by an enormous calculus, of a flattened oval shape, rough on the surface, and weighing twenty-seven ounces. Besides this there were innumerable smaller concretions, the largest being of the volume of a pea.

Had the nature of this tumor been clearly understood during life, the calculus might have been easily removed by an incision through the coats of the bladder, and the fatal event been averted.

GENERAL RESULTS OF THE DIFFERENT METHODS OF LITHOTOMY.

In concluding the subject of lithotomy in the male, it will not be amiss to reproduce in this place, in bold relief, the general results of the various operations described in the preceding pages. We shall thus be able to form a more correct estimate of their relative value, and thus determine, at least in part, what to retain and what to reject. In instituting such a comparison, however, it is to be borne in mind that these results, even the most elaborate of them, are only approximative, and that the whole subject requires to be more thoroughly investigated than it has yet been before we shall be justified in considering the great question involved in it as finally

¹ Mém. de l'Acad. de Chir. de Paris, t. ii. p. 28.

² Ephém. Natur. Cur. Ann. 5, obs. 71, 1686.

³ Thomas Paget, Lond. Med. and Physical Journal, vol. vi. p. 391, 1801.

and definitively settled. The results will appear more striking if they be exhibited in tabular form. The apparatus minor, and several other processes have supplied no statistics of their achievements.

Methods.	Cases.	Cures.	Deaths.	Proportion.
Apparatus major . . .	1,986	1,580	406	1 in $4\frac{7}{8}$
Lateral operation . . .	5,418	4,829	589	1 in $20\frac{1}{4}$
Bilateral method . . .	207	175	32	1 in $6\frac{1}{2}$
Recto-vesical section . .	83	67	16	1 in $5\frac{1}{8}$
Supra-pubic operation . .	180	141	39	1 in $4\frac{1}{3}$
Total . . .	7,874	6,792	1,082	1 in $7\frac{5}{8}$

Here it will be seen that the lateral section, as performed with the knife and gorget by different surgeons, from the time of Cheselden to the present moment, stands at the head of the list, exhibiting an array of success which no other capital operation whatever can even pretend to approach. The bilateral method comes next, giving a mortality of one in six and a half; a result greatly vitiated by the ill success of Dupuytren, since the loss of our own lithotomists is only one in about nine. The recto-vesical section follows close upon the bilateral, but it must be recollected that eleven patients out of the eighty-three had incurable fistule. The apparatus major and the supra-pubic operation are nearly on a par. How the results would stand if we could adduce an equal number of cases of these different methods, say 5,000 of each, is a question which cannot, of course, be answered, as the facts for its solution are wanting; nor is there any probability that they will ever be supplied, seeing that the lateral section is so immeasurably in advance of all the others, and that it is the one generally employed at the present day. Taking all the methods mentioned in the table together, the mortality of the operation of lithotomy in nearly 8,000 cases is in the ratio of 1 in $7\frac{5}{8}$.

If we now compare the results of the private cases of the lateral operation of American and European lithotomists, it will be perceived that the preponderance is vastly in favor of the former; in the ratio, indeed, of $20\frac{1}{2}$ to $12\frac{1}{4}$. The most splendid success of any one individual belongs to Dr. Dudley, who, in 207 cases, lost only 7, or 1 in $34\frac{1}{2}$. The most triumphant success in hospital practice occurred in the hands of Mr. Martineau, who, out of 84 cases, had only 2 deaths; a result, however, only a little superior to that of Pouteau, who lost but 3 cases out of 120, or 1 in 40. It is a remarkable fact that these lithotomists all used different instruments, the

American the gorget, the English the knife, and the French the lithotôme.

By a reference to the *London Medical Times and Gazette*, I find that, during the years 1853 and '54, 51 cases of lithotomy occurred in the various hospitals of the British metropolis, of which 41 recovered, and 10 proved fatal; thus showing a mortality of 1 in 5 $\frac{1}{5}$. The patients were all males, of whom 32 were under fifteen years of age. No conclusion can, of course, be drawn from so limited a number of cases; but the fact is interesting in a general point of view, the more so when it is recollected that the operators were quite numerous, and that they embraced some of the ablest surgeons of London.

The following table is introduced here as a farther illustration of the results of the lateral operation. At the time it was prepared, I was not acquainted with Dr. Von Wattman's method; but I have been recently informed by Dr. Hammer, of St. Louis, that he always performed the lateral section, employing for this purpose a cystotôme, or knife, shaped somewhat like a gorget, and resembling the instrument used by Rust of Berlin. None of the cases were selected for operation; for all, except four, that were admitted, were lithotomized.

Dr. Von Wattmann's¹ Table of 180 Cases of the Lateral Operation at the Surgical Clinique at Vienna, during a period of 35 years.

Age.	Cases.	Cures.	Deaths.	Proportion.
From 1 to 10 years . . .	71	64	7	1 in 10 $\frac{1}{5}$
" 10 " 20 " . . .	42	39	3	1 in 14
" 20 " 30 " . . .	30	21	9	1 in 3 $\frac{1}{3}$
" 30 " 40 " . . .	12	9	3	1 in 4
" 40 " 50 " . . .	6	3	3	1 in 2
" 50 " 60 " . . .	11	5	6	1 in 1 $\frac{1}{2}$
" 60 " 70 " . . .	8	5	3	1 in 2 $\frac{1}{2}$
Total . . .	180	146	34	1 in 5 $\frac{1}{4}$

No one can doubt that the mortality of lithotomy is materially influenced by the character of our cases, or the condition of the urinary organs and the general system. In this respect, lithotomy is on the same footing with every other capital operation. Simple cases will, other things being equal, be more likely to terminate favorably than such as are complicated with structural lesion of the

¹ *Über die Steinzerborung und ihr Verhältniss zum Blasenschnitte.* Wien, 1833. *Brit. and Foreign Med. Rev.* vol. iii. p. 254, 1837.

bladder, kidneys, and prostate gland, or serious derangement of the general health, whether induced by the presence of the calculus, or the existence of other disease. Surgeons who are much in the habit of cutting for stone generally pay great attention to the selection of their cases, rejecting, for the most part, such as are of a doubtful nature, lest the result should jeopard their reputation as lithotomists. Instances occur in almost every community of persons who are so much worn out by the effects of their disease as to render their recovery, after an operation of this kind, a matter of great uncertainty. In such an event, it becomes a nice question to determine whether the individual should be left to his fate, or be subjected to the use of the knife, for the purpose of affording him a chance for his life. The question will be answered differently by different surgeons, according to the nature of their temperament, and the course which they have prescribed to themselves for the government of their professional conduct. The cautious and timid, shall we add the selfish, will hesitate before they will undertake any case involving any serious risk; while the bold and reckless will plunge heedlessly into the danger and abide the consequences, whatever they may be, satisfied that if they gain nothing they will lose nothing. They thirst for *éclat*, and it is a matter of indifference to them how it is obtained. But, between these two classes there is another, who, influenced alone by conscientious motives and by the honor of their profession, only seek the good of their patients. They consider every case that falls under their observation with reference solely to its own intrinsic merits, entirely regardless of personal feeling and interest. They operate only with the hope of doing good, satisfied, if the result be unsuccessful, that they have discharged their duty. As for myself, embracing the advice of Celsus, "*melius anceps remedium*," that a doubtful remedy is better than certain death, or continual disease, I do not hesitate to operate whenever there is a reasonable prospect of benefiting the sufferer. Whenever the case is desperate, absolutely hopeless, both science and humanity alike shrink from the use of the knife.

STONE IN THE BLADDER OF THE FEMALE.

Women are much less liable to urinary calculi than men, though the reverse has been asserted by some very respectable authorities. In a practice of upwards of twenty-five years, I have met with but few instances of this affection in the other sex. As most of this time was spent in Ohio and Kentucky, where calculous disorders are quite

common, I am led to infer that the statement here made is strictly correct. The reason of this difference, as mentioned elsewhere, is owing, in part at least, to the shortness, width, and dilatibility of the female urethra, which thus permits the concretion, in most cases, to pass off immediately after it descends from the kidneys, or after it is formed in the bladder. In the male, on the contrary, the smallest particle of earthy matter is liable to be retained, and to become the nucleus of a stone. I am satisfied, also, from personal observation, that women suffer much less than men from urinary deposits; a circumstance which is easily understood when we reflect upon the fact that they are much more regular in their habits, that their mode of life is more simple, and that they are much less exposed to the various exciting causes of the disease. The period of life at which they are most subject to stone in the bladder is from the age of twenty to that of fifty.

Symptoms.—The symptoms which attend this affection in the female are similar to those which characterize it in the other sex. Frequent micturition, pain in the region of the bladder, and the presence of an unusual quantity of mucus in the urine, which is also occasionally tinged with blood, especially after rough motion or exercise, and the coexistence of renal and constitutional disorder, are the most common signs. In sounding, the patient is placed upon her back, on the floor or upon the edge of the bed; and the instrument,

Fig. 139.



a short steel rod, slightly curved at the extremity, is carried about through the interior of the bladder, so as to explore, if necessary, every recess of this organ. In young children, the finger may, if deemed advisable, be inserted into the rectum; but in grown subjects it is best always to introduce it into the vagina. The operation of sounding should always be conducted with as much delicacy as possible, the patient being covered with a sheet. Exposure of the person must be studiously avoided.

Stones in the female occasionally acquire an enormous bulk, and that, too, at an early period of life. In general, however, they are comparatively small, and do not weigh more than six, eight, or ten drachms. In their physical and chemical properties they do not

differ, so far as we know, from calculi in the other sex. In some instances, though rarely, the concretion projects into the urethra; and occasionally it has been known even to protrude at the outer opening of that tube. When this is the case, the patient almost always suffers from incontinence of urine, and from the various other evils incident to that disagreeable affection. My friend, the late Dr. Drake, saw a girl, aged eleven years, in whom this complication existed in a very marked degree. The calculus, which was removed piecemeal, with the forceps, filled nearly the whole bladder, and protruded at the external orifice of the urethra, which was so much dilated as to admit, with great ease, the introduction of the finger. The patient, who had suffered under vesical symptoms for seven years, completely recovered.

Spontaneous Expulsion.—Quite a number of cases are upon record in which calculi of large size have been expelled spontaneously from the female bladder. The urethra, under such circumstances, is gradually dilated, and probably also much shortened, from the pressure exerted upon it by the foreign body, which thus paves the way for its own evacuation. The expulsion is sometimes effected suddenly, perhaps under the influence of a violent attempt at micturition, or an effort at coughing, sneezing, or vomiting; but, in general, it is accomplished slowly, and with more or less pain and difficulty in voiding the urine. Instances of the spontaneous discharge of stones, weighing two, three, four, five, and even six ounces, are mentioned by different authors. Klauder¹ met with a case in which a stone, of the volume of a goose's egg, and weighing twelve ounces, was discharged in this manner. It was of a rounded figure, yellow, very compact, and remarkably smooth. In some of these cases, there was afterwards incontinence of urine; but usually the difficulty was transient, and the patients ultimately completely recovered. Occasionally the calculus is evacuated through the vagina, in consequence of ulceration of the anterior wall of this tube. Such an occurrence is fortunately rare, for it is generally, if not always, followed by a permanent fistule of the part.

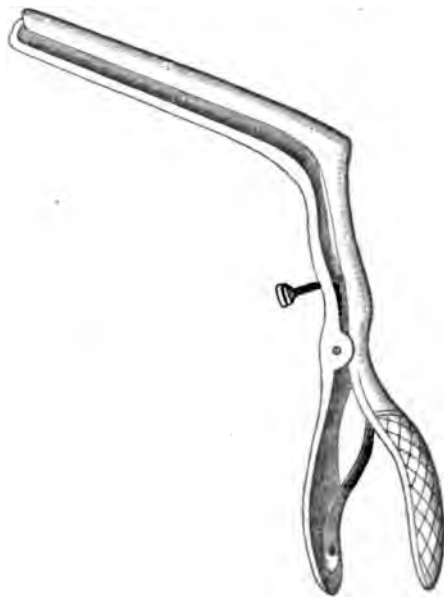
Treatment.—Various plans have been proposed and practised for the extraction of calculi from the female bladder. Of these only a few need be considered, as the rest are either obsolete, or are seldom required in the class of cases falling under the observation of the modern lithotomist. The operations to which I allude are dilatation

¹ *Miscel. Natur. Curios.*, Dec. 11, Art. 5, p. 895.

of the urethra, crushing, and incision, as practised by Dubois and other surgeons.

The method of *dilatation* has been practised from an early period of the profession, and has been received with various degrees of favor by different lithotomists. The principal objection to it is, its liability to be followed by incontinence of urine, in consequence of which it has of late years fallen very much into disrepute. It is more particularly adapted to small concretions, unaccompanied with any serious disease of the urethra and the neck of the bladder. The dilatation may be effected slowly, or rapidly, by means of instruments specially contrived for the purpose, as the one sketched at Fig. 140,

Fig. 140.



or by sponge tents, bougies, or catheters. I commonly use the latter, especially at the beginning, and one of gum is preferable to one of silver. When the stone is small, or not more than about three-quarters of an inch in diameter, the necessary dilatation may be procured in a few hours, or, at all events, in a few days; but, under opposite circumstances, it must be effected more slowly and cautiously, not only because it will be attended with less suffering, but also because there will be less risk of subsequent incontinence. In such a case important aid might be derived from the instrument here

represented. It is impossible to say how far, in any given instance, the procedure may with safety be carried. I should be very loth to trust to it exclusively where the stone is of great size; in such a case, I should dilate to a certain extent, and then resort to crushing, or, if the case was unfavorable for such a procedure, to incision of the urethra and the neck of the bladder.

The dilatation having been carried sufficiently far, the forceps are introduced, and the stone being seized, is extracted. In doing this, care should be taken not to grasp any of the folds of the bladder, or to lacerate the urethra. If the foreign body lies in a dependent situation, advantage may be derived from the finger in the vagina or the rectum.

Crushing may be employed when the stone is comparatively soft, and yet so large as to render it impossible to extract it without undue dilatation of the urethra. Indeed, I am well satisfied that almost any calculus, unless extremely hard or voluminous, may be disposed of in this way, and it is only surprising that the procedure is so seldom employed. The object may be effected either with a small pair of lithotomy forceps, rather narrower than common in the blades, or with Heurteloup's, Weiss's, or Jacobson's lithotripter. The operation is repeated from time to time until the foreign body is sufficiently reduced, and the fragments are washed out at each sitting in the usual manner.

Incision, according to the method of Dubois, which I prefer to any other, is easy of execution, perfectly free from the danger of hemorrhage, and not liable to be followed by incontinence of urine. The only instruments which are required for its performance are a straight staff, five inches in length, and a straight probe-pointed bistoury. The staff being introduced into the urinary sac, an incision is made directly upwards towards the pubic symphysis, extending through the urethra and the neck of the bladder, in their entire

Fig. 141.



length. The opening may afterwards, if necessary, be dilated with the finger to almost any extent that may be required for the safe and easy extraction of the calculus. When the concretion, however, is of unusual magnitude, and cannot be thus removed, the

incision may be extended downwards and outwards towards the tuberosity of the ischium. From the direction of the wound in this operation, there is much greater probability of an early reunion of its edges than when the incision is carried downwards, as in the more common methods, and consequently much less risk of incontinence of urine.

Mr. Fergusson,¹ of London, in order to lessen the chances of incontinence, has recently proposed an operation for extracting calculi from the female bladder, which seems to me to be admirably adapted to the object in ordinary cases. It consists in slowly dilating the urethra, by means of a metallic instrument, till it is capable of admitting the forefinger, and in then dividing the anterior half of the tube with a probe-pointed bistoury. The posterior portion of the urethra and the neck of the bladder are not touched by the knife, inasmuch as they are readily expanded under the pressure of the finger. In this manner, Mr. Fergusson extracted, some years ago, a stone three inches in circumference, and had the satisfaction to find that his patient had the power of retaining her urine immediately afterwards.

An operation, the reverse of that just described, was performed in 1845, by Dr. Baker,² of the State of New York. It consists in incising the posterior part of the urethra and the neck of the bladder, the meatus and anterior part of the tube being left intact. His patient, who was forty-five years of age, was placed on a table, and secured in the usual manner. A straight staff being introduced, the incision was commenced half an inch behind the meatus, and carried through the walls of the tube. The bistoury was now replaced by a probe-pointed lithotomy knife, which was next inserted into the groove of the instrument, and directed obliquely downwards and outwards, until it penetrated the bladder. The opening thus made was sufficiently capacious to admit the forceps, with which the calculi, ten in number, the largest being about the volume of a nutmeg, were successively seized and extracted. A catheter was maintained in the bladder for a fortnight, when, the wound being nearly healed, it was permanently laid aside. At the expiration of this period, the woman was able to retain her urine for two hours at a time, and exercise full control over its evacuation. Her convalescence, however, was considerably retarded by disease of the bladder

¹ *Practical Surgery*, p. 135, second London edition; *Druitt, op. cit.* p. 497.

² *Philadelphia Medical Examiner*, July, 1845.

and of the digestive organs, but she at length completely recovered without the slightest incontinence. My friend, Professor March,¹ of Albany, has had a perfectly successful case, by the same procedure, in a woman, thirty-seven years of age.

The absolute and comparative value of these two operations can be determined only by future observation. Both, it seems to me, are preferable to the ordinary methods, which are so liable to be followed by incontinence.

It is possible that the ill effects of the lateral operation of lithotomy in the female may have been somewhat exaggerated. However this may be, it is certain that it is not always followed by incontinence of urine, even when the stone is of great size. The truth of this assertion is fully sustained by the interesting case of the late Dr. J. Kearney Rodgers, of New York, the particulars of which he had the kindness to communicate to me a few months before his death. The patient was a widow, thirty-six years of age, during the last seven of which she had labored under symptoms of stone, and passed more or less white earthy-looking matter. The operation was performed with a long, broad, straight bistoury, the incision being carried downwards and outwards towards the tuberosity of the ischium. The stone was so large that, although the wound was considerably dilated, it could not be extracted until after it was seized with two pairs of forceps, expanded crucially over its long axis. No incontinence of urine followed. The day after the operation she retained half a pint, and the capacity of the bladder gradually increased as the cure progressed. Twenty years have elapsed since the operation, and the woman has never been troubled with calculous symptoms since. The stone, which Dr. Rodgers had the kindness to show me, and which I measured, weighed nine ounces and five drachms immediately after its removal. A portion of it was broken off during extraction. It is of an ovoidal shape; its surface is rough; and it appears to consist principally of uric acid. It is nine inches and a half in its long circumference, and seven inches and three-quarters in the short, at the widest part.

In 1849, my colleague, Professor Miller, succeeded in extracting, without previous dilatation, or incision, from a young girl, aged nearly fifteen years, a stone, weighing nearly four drachms and a half, very rough on the surface, and measuring a little over one inch in diameter. After having administered chloroform, he introduced

¹ MS. Letter to the author.

a pair of common curved polypus-forceps, with which, after a little exertion, he readily accomplished his purpose; not, however, without lacerating the mucous coat of the urethra, shreds of which hung out at the meatus, and were clipped off with the scissors. She had no bad symptoms, and went home in a few days, never having experienced the slightest retention of urine.

Whatever procedure be adopted, I conceive it to be a matter of primary importance that the patient should be kept perfectly at rest, in the recumbent posture, until the parts have regained their original tone. This should be done not merely where incision has been practised, though here it is of the greatest moment, but even where the operation is limited to dilatation. To a want of this precaution, much of the bad effects attendant upon these various procedures is doubtless justly ascribable.

CHAPTER XXI.

FOREIGN BODIES IN THE BLADDER.

It is necessary that I should make some remarks here respecting foreign bodies of the bladder introduced from without, and not developed in the organ. The subject may be appropriately considered immediately after that of urinary calculi, with the operations for the relief of which it is intimately associated.

The foreign bodies that may thus find their way into the bladder are too diversified in their character to admit of any very precise enumeration. The most common, however, as well as the most important, are balls, pins, needles, fragments of bone, pieces of straw, or other vegetable substances, and bits of catheters and bougies. Such bodies may be introduced into the bladder either accidentally, as in the case of balls and splinters of bone; or, they may be thrust up designedly, but with no intention of leaving them in this unfortunate situation. Many a poor fellow, in the act of committing onanism, has unwittingly introduced a piece of straw, wood, or wire into the urethra, from which it soon after slipped into the bladder. Surgeons have often broken off the catheter in the bladder, and a bougie has occasionally met with a similar mishap. The elm-bark bougie, at one time used a good deal in the Southwest,

has several times, within my knowledge, broken off in the bladder, from which it was obliged to be subsequently removed by an operation. I recollect a case of this kind which occurred many years ago in Ohio, where a man, while under treatment for stricture, met with this accident. A piece of the bougie broke off far back in the urethra, from which it soon after passed into the bladder, and so served as the nucleus of a tolerably large calculus. A substance of this kind will occasionally assume a contorted arrangement, as in Fig. 142, copied from the *Catalogue of the Royal College of Surgeons in London*. It was incrustated with phosphatic matter, and had escaped from the urethra into the bladder, where it received its singular shape.

Fig. 142.



In cauterizing the neck of the bladder for the cure of seminal weakness and other affections, the cup of Lallemand's "porte-caustique" has been repeatedly left in the interior of this organ, much to the annoyance and chagrin of the surgeon. Accidents of a similar character occasionally happen in the operation of lithotripsy; and in 1841, Mons. Leroy addressed a paper to the Royal Academy of Sciences of Paris, in which he gives an account of an instrument invented by him for seizing and extracting pieces of the stone-crusher in the event of its breaking off in the bladder. Balls sometimes enter the pelvic cavity, and from thence gradually find their way into the bladder by ulcerative absorption. In the same manner a fragment of bone, detached by external violence, or the effects of disease, has repeatedly been known to pass into this organ.

However introduced, the effects upon the foreign substance and the bladder are generally similar, or at any rate, if they differ at all, they differ only in a very slight degree. The extraneous body usually becomes incrustated in a very short time with earthy matter, the deposit of which often proceeds with extraordinary rapidity, and sometimes attains a large bulk in a few months. The deposit is generally of a lithic or phosphatic nature; in rare cases, it is oxalic. The symptoms awakened by the presence of the intruder, whatever it may be, are similar to those which characterize stone in the bladder. The diagnosis is commonly easily established by the history of each particular case, aided, where any doubt remains, by a careful exploration with the sound.

A foreign body, introduced into the bladder, whether designedly or otherwise, will occasionally perforate its walls, and, escaping into the peritoneal cavity, excite fatal inflammation. Such an event will, of course, be much more liable to happen when the substance is long and inflexible than when it is possessed of the opposite qualities, as, in the latter case, it is much more easily accommodated, and therefore less likely to produce injurious pressure. Thus, a piece of gum-elastic bougie, leather, or slippery elm, is usually, as far as such an effect is concerned, a comparatively harmless tenant, because it is apt, soon after reaching the bladder, to be rolled up into a comparatively small bulk by the action of the heat and moisture of the parts, and is thus made to occupy a proportionably small space. A hard substance, on the contrary, retains its original form, and is, therefore, more liable to impinge injuriously upon the coats of the organ, causing, at least occasionally, laceration, ulceration, or gangrene.

CASE.—A very extraordinary instance of perforation of the bladder, by a foreign body, has been reported, within the last few years, by my friend, Professor Parker, of New York.¹ It occurred in Vermont, in the practice of Dr. Pond, in a man, fifty years of age, who had been in the habit of indulging in masturbation. One day, he introduced a leaden bougie, ten inches in length by three-quarters of an inch in diameter, and weighing seventeen ounces, which inadvertently slipped from his fingers, and passed beyond his reach along the urethra. Severe suffering was the result, and the foreign body was easily detected in the bladder, both by the sound and by the finger in the rectum. An operation was determined upon, but before the man could be induced to submit to it, the bladder gave way, and the bougie passed into the abdomen. Gastrotomy being at length performed, the substance was found to be entirely lodged in the peritoneal cavity, having escaped from the bladder through a rent in its posterior wall. For a while, the patient seemed to be in a fair way of recovery; but, at the end of the ninth day, he became unmanageable, and broke open the wound, and died in a fortnight after the occurrence of the accident.

The extraneous body, if small, may be expelled spontaneously; but, generally speaking, it must be extracted by operation. A bullet, of ordinary size, might be removed simply by dilating the urethra; or, this failing, by Cooper's forceps. In an instance recorded by Elsholz,² the ball was sufficiently small to pass off by the urethra. Where the foreign body refuses to come away of its own accord, or the forceps are unavailing, relief must be attempted by the lateral operation, executed in the usual manner. In the thirty-third

¹ Dr. Stephen Smith, *New York Journ. Med. and Surgery*, New Series, vol. ix. p. 105. 1852.

² *Ephemerides Naturæ Curiosorum*, Ann. ix. x. Obs. 85.

volume of the *Transactions of the Royal Medical and Chirurgical Society of London*, Mr. E. M. MacPherson, of the British Army, gives the particulars of a case in which, by this means, he successfully extracted from the bladder of a soldier, an iron ball, weighing an ounce and thirty-eight grains; it had become incrustated with a very thin layer of sabulous matter, and had been retained about seven months and a half, having caused all the ordinary symptoms of calculus. In a case mentioned by Mons. Baudens, that surgeon was induced to have recourse to the high operation, on account of the ball having entered at the bottom of the linea alba, so that it was only necessary to enlarge the wound to reach the cavity of the bladder.

Appended to Mr. MacPherson's case is a table by Mr. James Dixon, of London, of eighteen others, in which the operation was performed by different surgeons, in ten successfully, and in three unsuccessfully; the result of the remainder not being indicated. As the facts in this table are of deep practical interest, I shall take the liberty of copying it, with a few alterations and additions, so as to adopt it more directly to my purpose.

Table of 18 Cases of Lithotomy for the Extraction of Foreign Bodies from the Bladder.

SITUATION OF WOUND.	DISPOSITION AND SIZE OF THE CONCUSSION.	TIME OF OPERATION.	RESULT.	OPERATOR.	AUTHORITY.
1 Hypogastrium	Surrounded by calcareous matter; size of a pigeon's egg.	Recovery	Recovery	Pelletier	(Guillier. <i>Observations Iatrophirurgiques</i> , 2d edition, by Thumaslin, 1791.
2 Hypogastrium	Surrounded by calcareous matter.	Not indicated	Not indicated	Frère-Jacques	Dionis. <i>Cours d'Opérations</i> , p. 170, 1708.
3 Upper and back part of thigh	Surrounded by calcareous matter.	4 or 5 years	Not indicated	Hidout	(Cheselden. <i>Treatise on the High Operation</i> , 1723, Plate X.
4 Hypogastrium		4 or 5 mos.			
5 Over ilium	Surrounded by calcareous matter.	Several years	Not indicated	Morand, Sr.	Morand. <i>Traité de la Taille au Haut Appareil</i> , p. 234, 1728.
6 Bottom of the iliac fossa	Placed ball, with piece of shirt and clots of blood, covered by calcareous matter.	10 years	Not indicated	Maréchal	(Garengot. <i>Traité des Opérations</i> , 2d edition, 1731.
7 Sacrum and rectum	Size of a small hen's egg.	10 years	Recovery	Duvergé	Percy. <i>Manuel des Chirurgiens d'Armée</i> , p. 246, 1792.
8 Right groin	Ball incrustrated by earthy matter; the whole weighing over four ounces.	4 days	Not indicated	Langenbeck	Larrey. <i>Clinique Chirurgicale</i> , vol. II, p. 520, 1820-36.
9 Over false ribs	Ball lodged in a cyst at the upper and forepart of the bladder.	8 years	Recovery	Larrey	Larrey. <i>Op. cit.</i>
10 Over tenth rib	Ball lying loose in the bladder, and covered with phosphatic matter.	6 years	Recovery	Soubertbielle	Larrey. <i>Op. cit.</i> , vol. II, p. 535.
11 Above the pubes	Fragment of bone adhering to the ball.	5 months	Recovery	Larrey	Larrey. <i>Op. cit.</i> , vol. II, p. 537.
12 Above the sciotic notch	Ball free from incrustation; two pieces of wadding discharged by urethra.	7 months	Recovery	Guthrie	Guthrie. <i>Lectures on Wounds and Injuries of the Abdomen and Pelvis</i> , 1847.
13 Sciotic notch	Ball found at the left side of the prostate.	12 months	Recovery	Cline	Chollus's <i>System of Surgery</i> , note by South, vol. I, p. 482.
14 Sacrum	Lying loose in the bladder; extracted by high operation.	18 months	Recovery	Colles	Colles. <i>Lectures on Surgery</i> , by McCoy, p. 183. Philad. 1845.
15 Above pubes	Calculus incrustation; size of a hen's egg; fracture of coccyx.	Soon after	Recovery	Colles	Baudens. <i>Clinique des Plaies d'Armes à Feu</i> , p. 384, 1836.
16 Side of coccyx	Calculus matter surrounding it; size of an egg.	30 years	Fatal	Baudens	Fabriceus Hildanus. <i>Opera Omnia</i> , obs. p. 250. Francof. 1646.
17			Fatal		J. N. Bieringerus. <i>Obs. et Curat. Medicinal</i> , cent. v. p. 401. Montelgard, 1673.
18			Fatal		T. Bartholini. <i>Epistolæ Medicinalium</i> , cent. III. Hagae. Com. 1740, epist. 35. G. Rogerus to Bartholinus.

Mr. Guthrie¹ mentions the following case, which is directly in point in connection with the preceding table. At the battle of Chillianwallah, a man was wounded by a ball, which afterwards became the nucleus of a stone. A gentleman, in the service of the East India Company, performed the lateral operation, and successfully removed the foreign body.

There is at least one instance in which a patient, after this accident, was subjected to the operation of lithotripsy. It occurred in the hands of Mons. Demarquay, by whom it has been narrated in the second volume of the *Mémoires de la Société de Chirurgie of Paris*, published in 1851. The patient was struck on the left side of the linea alba, just above the pubes, the ball traversing the pelvis, and emerging at the lower part of the right buttock. Notwithstanding the use of the catheter, urinary infiltration took place anteriorly, followed by numerous abscesses, and by erysipelas in different portions of the body. At the end of several months, splinters of bone were discharged at the posterior wound, and an examination of the bladder revealed the existence of a calculus. The operation of lithotripsy was performed, causing great pain, and followed by the expulsion of numerous calcareous fragments, attached to one of which was a small piece of bone. The urinary fistule refused to heal, and the man finally died exhausted.

Many cases are upon record where bits of gum-elastic catheters and bougies were extracted from the bladder, by means of the forceps, an excellent pair of which is represented in the annexed drawing. In Fig. 143, the blades are open; and in

Fig. 143.

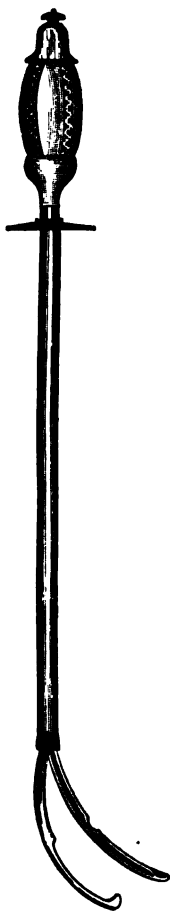


Fig. 144.



¹ Commentaries on Surgery of the war in Portugal, Spain, France, and the Netherlands, p. 580. London, 1853.

Fig. 144, they are shut upon the extraneous substance. The operation is of course much more difficult in the male than in the female, on account of the greater length and narrowness of the urethra. It is well enough, in all cases of this kind, to dilate the tube for several days previously, to facilitate the movements of the instrument, as well as to afford more room for the foreign body as it is drawn along. By a dexterous twist of the hand, the forceps are made to seize the extremity of the intruder, which may then be withdrawn without difficulty; whereas, if it be grasped at its middle, or even but a short distance from its extremity, it will bend upon itself, and thus offer an insuperable barrier to extraction. The late Mr. Tyrrell, of London, had the good fortune, on one occasion, to clear in this way the bladder of a man of forty of a piece of silver catheter, three inches in length, and of the size of a No. 10. The foreign body, situated horizontally at the fundus of the viscus, was first dislodged with the end of a sound, and brought down behind the prostate gland. After several ineffectual attempts, he succeeded in seizing the end of the tube, and drawing it into the urethra, where the forceps lost their hold. Inserting his finger immediately into the rectum, he compressed the urethra so as to prevent the foreign body from receding, and then reintroducing the forceps, he at once caught and removed it. I have been induced to give an abstract of this interesting case, because it shows the manner in which the operation of extraction should be conducted in similar cases.

When the foreign body is a pin or a needle, it may sometimes be entrapped by the eye of a catheter, as in the memorable case of Lamotte. This distinguished surgeon being called to a young woman, into whose bladder a large pin, attached to her napkin, accidentally dropped headforemost, he sounded her thrice with all possible patience, each time feeling the foreign body without being able to entangle it. Upon making a fourth trial, however, he was more successful. Moving the instrument carefully and gently about in the bladder, the pin fell across the eyes of the tube, with which it was withdrawn, not, however, without producing considerable laceration of the urethra.

PART II.

DISEASES AND INJURIES OF THE PROSTATE GLAND.

THE prostate gland, from the peculiarity of its situation, and its intimate connection with the bladder, the urethra, and the seminal vesicles, is constantly exposed to inconvenience and hardship, and hence, like all other parts of the body, it is liable to various diseases; not so much, however, from any proneness of its own, as from its unfortunate relations. Until the age of puberty, it has merely a rudimentary existence, and is, therefore, seldom affected in any way. After its functional activity, however, is awakened, it becomes more liable to disorder, and this tendency may be said steadily to increase as we advance in life. With the exception of acute inflammation and suppuration, tubercle, and encephaloid, all the lesions of the prostate are more common in old age than in infancy and adolescence.

The affections of the prostate may be conveniently arranged under the following heads: 1. Wounds; 2. Inflammation; 3. Suppuration and Abscess; 4. Ulceration; 5. Hypertrophy; 6. Atrophy; 7. Scirrhus; 8. Encephaloid; 9. Colloid and Melanosis; 10. Tubercle; 11. Cystic disease; 12. Hemorrhage; 13. Calculi; 14. Phlebolites. These affections will be considered in the order here enumerated.

CHAPTER I.

WOUNDS OF THE PROSTATE.

WOUNDS of the prostate are of such unfrequent occurrence as hardly to merit attention in a practical point of view. The subject has been considered somewhat in detail by M. Vidal in his *Treatise on Surgery*, and with a degree of importance to which, in my judg-

ment, it is not entitled. All that is really valuable respecting it, has been already pointed out in connection with retention of urine, catheterism, and lithotomy. Nevertheless, as the subject has found its way into at least one system of surgery, and that the most able now extant, it would not be proper to omit the consideration of it wholly in a work of this nature. It is for this reason mainly that I shall endeavor to exhibit, in as concise a manner as possible, the leading facts of the case.

Wounds of the prostate are the result either of accident or design. In the latter case, they are made by the surgeon with a view to the accomplishment of some useful purpose, as the extraction of a stone or the evacuation of the urine. However induced, they vary in extent and importance, from a mere scratch, as it were, to the complete division of the organ. In respect to their character, they are of different kinds, as incised, lacerated, punctured, and gunshot, as in other parts of the body.

The best example of an *incised* wound of this gland is that which occurs in the lateral operation of lithotomy, in which the organ is always divided on one side, generally the left. The extent of the wound varies in the hands of different surgeons, some being in favor of a small, others of a free division. The subject, which is of great practical importance, has been discussed elsewhere, and need not, therefore, detain us here. A wound of this nature derives its chief interest from its extent, which, if too great, or carried beyond certain limits, is extremely liable to be followed by urinary infiltration, abscess, or gangrene of the neighboring parts rather than of the gland itself. When confined within proper bounds, it rarely inflames much, and would no doubt often, if not generally, unite by the first intention, if it were not for the contact of the urine, which has a tendency not only to wash off any lymph that may be effused upon its surface, but also to deprive this substance of its vitality. It is for this reason that the opening made for the extraction of stone seldom, if ever, heals in any other manner than by the granulating process. Some swelling usually occurs in the parts soon after the operation, in consequence of which the urine passes in great measure along the urethra, but begins to flow again by the abnormal route as the tumefaction subsides. Granulations gradually spring up, the edges of the wound approach each other, and in eighteen or twenty days the reunion is generally completed. Although this is the ordinary course pursued by nature in a wound of this description, yet a case occasionally occurs in which the

closure is effected almost immediately, apparently by the adhesive process. Beclard once performed the bilateral operation upon a patient who passed all his urine in less than three hours afterwards through the urethra, in consequence, as was supposed, of the speedy reunion of the edges of the wound in the prostate gland. Such an occurrence is, of course, exceedingly rare, and nothing smacks of greater ignorance than to hear men speak of it as a common event.

Lacerated wounds of the prostate are generally produced by the forcible use of instruments in attempting to draw off the urine. Any portion of the gland may suffer in this way, but the one which is most liable to be injured is the middle lobe, which, from its size and situation, often forms a serious obstacle to the evacuation of the bladder, and therefore is most commonly perforated by the catheter. The whole gland is sometimes accidentally bored, if such an expression is allowable, in this manner, without being followed by any serious mischief, much less by loss of life. Civiale relates¹ a remarkable example, which may be briefly mentioned here, as it strikingly illustrates the comparative harmlessness of this form of injury. A false passage, commencing at the right side and anterior part of the gallinaginous crest, traversed the gland from before backwards, and from above downwards, and led to a purulent depôt between this body and the rectum. Another, which began at the middle line, behind the crest, pierced the prostate in the same direction as the preceding, and terminated at the same point. A third commenced at the right side of the second, and immediately began to bifurcate; one process, being directed outwards, opened into the bladder behind the right lobe of the gland, while the other, which inclined obliquely outwards and backwards, also communicated with the bladder by forming, in front of the orifice of the urethra, on the same side, a subdivision separated only by a thin, narrow septum. All the passages were of long standing.

Punctured wounds of the prostate, as these perforations may be appropriately denominated, are sometimes dangerous from the manner in which they interfere with the neighboring parts. The gland itself, as has just been seen in the remarkable instance cited from Civiale, suffers, in general, comparatively little. The passages soon become lined by false membrane, and assist afterwards in conducting the urine to the urethra. It is only when they pene-

¹ *Traité Pratique des maladies des Organes Genito-Uriinaires. Deuxième partie, 1841.*

trate the pelvic fascia that they are at all liable to be followed by violent inflammation and death. A perforation of this kind sometimes extends into the rectum, and leads to the formation of a fistule.

The prostate is occasionally severely lacerated and contused in extracting urinary calculi, either by the forceps, or the foreign body, which may be disproportionably large, or unusually rough on the surface. Not a few cases have occurred in which the greater portion of the gland has been rudely severed, or so violently bruised as to die and slough. Many an inexperienced operator has seized an enlarged middle lobe, and torn it off, under a belief that his forceps had hold of a stone. Such errors, which, however, nowadays, are fortunately rare, can seldom fail to be followed by the most disastrous consequences. A severe wound of the prostate is sometimes made by a splinter of bone, in fracture of the pelvis. The accident is an important one, inasmuch as it is apt to give rise to suppuration, and even sloughing, both of the parenchymatous substance of the organ and of the surrounding parts.

Gunshot wounds of the prostate are exceedingly rare, and so little is known concerning them, that it is unnecessary to enter into any details respecting their symptoms and treatment.

The most prominent effects of wounds of the prostate are: 1. Hemorrhage, which, however, is seldom considerable; 2. Inflammation; 3. Infiltration of urine and sloughing; 4. Retention of urine from tumefaction of the affected parts, and the pressure which they exert upon the caliber of the prostatic portion of the urethra; 5. Urethro-vesical and urethro-rectal fistules; 6. Abscess, situated either in the substance of the organ, or between the gland and the rectum.

Wounds of the prostate, especially when unattended by lesion of the skin, must necessarily be more or less obscure in their character, if not wholly beyond our power of diagnosis. This being the case, little need be said on the subject of treatment, beyond the fact that this should be conducted upon general principles. From the great liberty which we may take with this gland, the slight pain which attends its injuries, and the little sympathy which it enjoys with the rest of the system, or even the parts with which it is more immediately associated, it is obvious that ordinary wounds, whether simple, lacerated, contused, or punctured, are generally amenable to the common antiphlogistic means, and that there is much less reason to dread them, in relation to inflammation and its effects, than the surrounding structures.

Wounds of the prostate are sometimes attended by troublesome hemorrhage, especially in elderly persons. As there are no large arterial trunks from which the bleeding can proceed, it is not improbable that it emanates, under such circumstances, from the prostatic plexus of veins, which are often varicose and much increased in volume, particularly in calculous subjects, or in such as are affected with excessive enlargement of the prostate. A severe, and even fatal hemorrhage, however, might be caused by the division of an anomalous artery, which occasionally passes along the side of this gland, on its way to the penis, and which has been cut, in one instance, at least, in the lateral operation for stone. From whatever source the hemorrhage arises, it is obvious that our chief reliance, for arresting it, must be placed upon compression, since it would be folly to attempt ligation. The manner of applying compression has been pointed out in connection with the operation of lithotomy, and need not, therefore, detain here.

CHAPTER II.

ACUTE PROSTATITIS.

SECTION I.

GENERAL OBSERVATIONS.

ACUTE inflammation of the prostate seldom exists as a primary affection, except when it is produced by direct injury. In general, it is altogether of a secondary character, or the result of an extension of disease from the adjacent and associated organs. Its own structure disqualifies it, in a great degree, for originating morbid action; a circumstance in which it may be said to bear a close resemblance to the pancreas, the salivary glands, and the thyroid body. Acute inflammation is most frequently met with in middle life, when the genital organs are in their full vigor; on the contrary, it is comparatively rare in childhood and old age, when these organs are either in a state of latency, or ill fitted for the discharge of their functions. The disease, as in other parts of the body, may be idiopathic or traumatic.

Symptoms.—The attacks of acute prostatitis are sometimes sud-

den and unexpected; at other times gradual, and preceded by symptoms of general indisposition. From whatever cause it may proceed, whether from cold, external injury, retained urine, metastasis from gout and rheumatism, or extension of gonorrhoeal inflammation, the first intimation, in general, of its occurrence is pain, burning, and sense of weight at the neck of the bladder, soon followed by a frequent and almost irrepressible desire to void the urine. The pain at first is slight, and of a dull, heavy, aching character; but, as the malady progresses, it rapidly augments in severity, and becomes sharp, darting, pungent, or stinging; it is deep seated, more or less constant, and is increased by the erect posture, by any sudden concussive movements of the body, by pressure upon the perineum and hypogastrium, by defecation and micturition, and by pressure of the finger in the rectum. The pain often shoots along the pubes, thighs, ureters, and spermatic curvæ: and is sometimes exceedingly distressing in the sacro-lumbar region. In the more violent forms of the complaint, and especially when suppuration is threatened, it is throbbing or pulsatile. The testicles are retracted towards the abdominal rings, and a feeling of numbness is experienced in the surrounding parts. The difficulty of micturition, which is usually a prominent feature, even in the early stage of the disease, keeps steady pace with the swelling of the prostate, and is often succeeded by complete retention. The urine is generally scanty, high-colored, dirty, or turbid, and so acrid as to occasion severe scalding or burning as it passes along the urethra. So agonizing, indeed, is this sensation that it is frequently compared by the patient to the effects produced by the contact of molten lead. The urine commonly contains a considerable quantity of mucus; the product both of the affected gland and of the urinary bladder, the inner membrane of which always participates, at an early period, in the morbid action. In some instances, especially in the more violent forms of the disease, the fluid is tinged with blood.

The rectum generally becomes involved, from extension of the original disease, at an early stage of inflammation. The patient experiences a frequent inclination to go to stool; the parts are exquisitely tender and painful; the feces are voided with much difficulty, and, not unfrequently, in a flattened or compressed form; and there is a constant feeling of tenesmus, as in dysentery and cystitis. In many cases, when the disease has existed several days, the bowel feels as if it were stuffed or filled with a foreign body:

and, if the finger be introduced into it, the inflamed gland will be found to be exquisitely tender, and to form a tumor which is so large, in some instances, as almost to obliterate the cavity of the tube. If an attempt be made, at this stage of the complaint, to pass a catheter the instrument will be likely to become arrested by the enlarged organ and to cause severe pain and spasm. Priapism sometimes attends, and occasionally there are involuntary discharges of semen, generally tinged with blood.

These local symptoms are generally accompanied by well-marked constitutional disturbance. The countenance is flushed; the skin hot and dry; the pulse full, hard, and frequent; the tongue furred, and the appetite impaired. The thirst is commonly urgent; there is excessive restlessness; the bowels are constipated; and not unfrequently there is nausea and even vomiting. Delirium occasionally exists, and generally, especially when attended by rigors, denotes the approach of suppuration.

Diagnosis.—Acute prostatitis is liable to be mistaken for other affections. Cystitis and stone in the bladder are the diseases with which it is most apt to be confounded. In general, however, the diagnosis is sufficiently easy. The characteristic symptoms are the deep-seated, burning, and throbbing pain, the gradually increasing difficulty in micturition, the excessive scalding of the urethra as the urine flows over its mucous surface, the feeling of weight and stuffing in the rectum, the constant tenesmus and desire to go to stool, and the flattened form of the feces. When all these phenomena are present, hardly a reasonable doubt can exist in respect to the true nature of the malady, especially if it have supervened suddenly upon external violence or a suppression of a gonorrhoeal discharge. Fortunately, however, the surgeon need not rely upon these or any other symptoms to determine the diagnosis. In all cases he has it in his power to examine the gland directly with the finger and the catheter. With the former of these in the rectum, the prostate, as before stated, can be distinctly felt as a solid, painful tumor, sometimes almost sufficiently large to close the tube and seriously impede the passage of the feces; whilst, if he attempt to introduce the latter into the bladder, he will find it exceedingly difficult, if not impracticable, to succeed, unless he possesses more than ordinary skill in the management of this instrument. The enlargement upon which these obstacles depend is, of course, always more conspicuous after the inflammation has made some progress; in its early stages it is frequently very slight.

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In cystitis the prostate is little, if at all, enlarged; there is less pain and tenderness on pressure of the perineum and the rectum; the urine is retained with more difficulty, and is generally voided every few minutes; the lower bowel suffers less, and the patient does not experience the feeling of fulness and stuffing about the anus that he does in inflammation of the prostate. In stone of the bladder, the symptoms are usually less urgent than in either of the other affections, and all doubt about the case generally vanishes under the operation of sounding.

Causes.—The causes of acute prostatitis are both numerous and diversified, and, as they have an important practical bearing, a rapid survey of them cannot be uninteresting or useless to the surgeon.

One of the most common exciting causes of this affection is irritation of the mucous membrane of the urethra, especially that form of it which attends gonorrhoea. Anatomy furnishes a ready and satisfactory reason of this occurrence. The lining membrane of the urethra, the seat of the inflammation, is prolonged backwards over the neck of the bladder, and from thence into the excretory ducts of the prostate, and it is very easy, therefore, to see how morbid action, going on in one of these parts, may extend to the other. In short, the disease, in such a case, takes place, not from sympathy, but in consequence of the continuity of structure, just as disease sometimes spreads from the nose to the lachrymal passages, or from the duodenum to the excretory canal of the liver, and even to the liver itself. This mode of propagating morbid action is not uncommon, and has been long known to pathologists. It is only when the prostatitis is developed soon after the contraction of a gonorrhoea, and while the irritation is limited to the anterior extremity of the urethra, that it can be said to be truly sympathetic; in all other circumstances, it is directly dependent upon an extension of the morbid action along the mucous surface. A gonorrhoea, in such cases, inflicts the same injury upon the prostate that it occasionally inflicts upon the testicle, shaking off, at least for a time, its own burden, and fastening it upon its neighbor.

Another occasional cause of acute inflammation of this gland is stricture of the urethra; more particularly when it is seated low down in the tube, and is accompanied with difficult micturition. The violent and continued straining which is required to surmount the mechanical obstacle, keeps up an incessant irritation in the

prostate, leading to engorgement of its vessels, and finally, in many instances, to inflammation of its substance. I am satisfied, from ample observation, that whatever has a tendency permanently to diminish the stream of urine and impede its flow, whether it depends upon disease of the urethra, the bladder, or the prostate, is calculated, in no inconsiderable degree, to awaken this affection. In old subjects, indeed, I do not hesitate to regard it as the most common exciting cause of all. It will be perceived, therefore, if this conclusion be correct, how important it is, in a practical point of view, to be acquainted with this circumstance.

Venereal excesses, onanism, frequent and prolonged erections, and constant exercise upon horseback, will also occasionally induce this disease, by maintaining habitual engorgement of the prostate. Hemorrhoidal tumors, ulcers, carcinoma, ascarides, and other affections of the rectum and the anus, probably act in the same manner. Drastic and heating purgatives, particularly such as manifest a direct tendency to the lower bowel, sometimes cause the disease, though less frequently, I think, than is generally imagined. Velpéau asserts that stimulating diuretics, as copaiba and cubebs, employed in the treatment of gonorrhoea, are apt to produce it. My own opinion is that such a result rarely, if ever, follows the exhibition of these medicines; I have constantly used them for the last twenty-five years, in large as well as in small doses, and in every stage of the malady, and yet I cannot recall to my recollection a solitary instance in which they appeared to exert any pernicious effect upon the prostate. I am not aware, moreover, that the statement of the French surgeon has been verified by the experience of others equally entitled to credence. That the internal use of cantharides, which act specifically upon the neck of the bladder, stimulating injections, and caustic applications, may occasionally produce inflammation of this gland, is indisputable.

Another cause of this complaint is injury applied to the perineum, or directly to the organ itself, as in the rude introduction of the catheter, or the protracted retention of this instrument in the bladder. The operation of lithotomy, in which the prostate is always involved, is rarely followed by severe inflammation of this body.

Finally, acute prostatitis may be induced by the sudden suppression of the cutaneous perspiration, by cold applications to the perineum, especially when the body is overheated and there is a

gonorrhoeal discharge, and by the inordinate use of high-seasoned food, wine, and alcoholic liquors.

Progress and Termination.—Acute prostatitis is generally rapid in its course. It seldom continues longer than eight or ten days without tending to resolution or suppuration. When the attack is moderate, or even when it is violent, provided it be combated by prompt and efficient means, it usually ends favorably. When resolution is about to take place, the local distress gradually diminishes, micturition is performed with more facility, the urine becomes more abundant and assumes a lighter color, the fever subsides, and the skin is rendered uniformly soft and moist. The formation of matter is denoted by an obstinate persistence of the inflammatory symptoms, both local and general, by rigors, chills, or shiverings, by violent flushes, by a heavy, throbbing pain in the affected part, by delirium, and, not unfrequently, by retention of urine. Idiopathic prostatitis never terminates in gangrene; but this effect occasionally, though rarely, follows the traumatic form of the affection.

Pathological Changes.—The swelling of the prostate, in simple cases of inflammation, depends mainly upon an effusion of serum into the meshes of its cellular tissue, and upon a dilated condition of its capillary vessels. In the more severe forms, there is, in addition, a deposition of coagulating lymph, of blood, and even of pus. The latter fluid generally exists in minute, disseminated points, not larger than a pin's head, and of a pale straw color. They are most conspicuous in the cellular substance of the organ, a section of which, when thus affected, bears a tolerably close resemblance to the pulmonary tissues in a state of grayish hepatisation.

The gland is red, and infiltrated, but still retains its cohesive properties; it is only in the advanced stages of the disease that it becomes soft and friable. The mucous follicles are enlarged, injected, and distended with a thick ropy secretion; the excretory ducts, on the contrary, are generally diminished in size, and sometimes even obliterated by the adhesion of their sides. Occasionally they yield, upon pressure, a thin, bloody, and slightly viscid fluid. The fibrous capsule is unnaturally red and vascular, tense, and covered, here and there, with plastic deposits. The size of the gland varies, in different cases, from the slightest increase of the natural bulk, to the volume of a walnut, a hen's egg, or an orange. The swelling generally involves both the lateral lobes, though not in an

equal degree. The body and middle lobe are also frequently much enlarged. The parts adjacent to the prostate usually participate in the morbid changes.

Treatment.—Acute prostatitis, being a rapid and highly dangerous disease, must be met with the most energetic antiphlogistic measures. Free depletion by the lancet, by leeches, and by cups is almost always indicated, and should be practised with the least possible delay. The object, of course, in all cases, is to promote resolution and prevent suppuration. The amount of blood abstracted from the arm must vary, as in other phlegmasial affections, according to the age and habits of the patient, the state of his pulse, the duration and intensity of the morbid action, and the effects of previous treatment. It should be taken from a large orifice, while the patient is in the semi-erect posture, and should be permitted to flow until there is an approach to syncope, or, in bad cases, until this has actually taken place. One such bleeding will effect more good in subduing the malady than half a dozen small ones. If the bowels are overloaded, the venesection is immediately followed by an active purgative, consisting of an ounce of sulphate of magnesia with the eighth of a grain of tartar emetic; or, if there be decided evidence of bilious derangement, of twenty grains of calomel and the same quantity of jalap. The object should be to render the fecal matter as liquid as possible, in order that, as it descends along the rectum, it may not injuriously compress the affected gland. All griping and heating cathartics are inadmissible; and it is preferable, as a general rule, to avoid this class of remedies altogether, and to rely principally, at least for the first few days, upon laxative enemata.

If much fever be present, accompanied with heat and dryness of the skin, thirst, restlessness, and high arterial action, the venesection may be repeated, or the patient may at once be put upon the use of tartrate of antimony. The dose should not at first exceed the sixth or eighth of a grain, repeated every two or three hours, and the effects of the remedy should be carefully watched, lest it produce vomiting and griping, which would necessarily do harm. Or, instead of this medicine, if the activity of the pulse has been moderated by the previous treatment, Dover's powder, or the solution of acetate of ammonia, may be given, aided by tepid demulcent drinks, and the warm bath. The kind of bath is an object of no little importance in the management of this disease. The hip-bath is the one usually recommended; but I am satisfied that its beneficial

effects are frequently more than counterbalanced by the inconveniences which attend its administration. To be at all efficacious in relaxing the cutaneous exhalants, it is necessary that the immersion should be continued at least from twenty-five to forty-five minutes; a period which must inevitably lead to great fatigue, to say nothing of the afflux of blood that is likely to take place to the inflamed organ from the peculiar position of the trunk. It is for these reasons that I seldom resort to this agent in the treatment of acute disease either of the prostate or urinary bladder. All the good effects that can be desired in such cases may be readily obtained from the steam bath, prepared either by conducting the vapor of hot water to the body of the patient from a teakettle, or by placing near him, under the bedclothes, a few hot bricks, wrapped up in flannels previously moistened with vinegar and water. By either contrivance, free diaphoresis may generally be induced in a few minutes.

When the violence of the local inflammatory action has been somewhat subdued by the foregoing measures, and sometimes, indeed, even before, one of the most powerful means for promoting resolution is leeching. The best points for performing the operation are the perineum, the parts around the anus, the inner and upper surface of the thighs, the pubes, and the hypogastric region. The number of leeches to be applied must vary from eight or a dozen to thirty, forty, or fifty, according to the exigencies of each particular case; and the repetition of the bleeding must be governed by the state of the pulse and the continuance or subsidence of the local action. Occasionally blood may be advantageously taken by leeches from the anterior wall of the rectum, previously dilated with the speculum; in general, however, the parts are too tender and painful to admit of the requisite distension. Should the operation be determined upon, a bivalve speculum should be selected, the upper extremity and posterior cleft of which are to be closed with cotton, to prevent the leeches, on the one hand, from ascending the intestine, and, on the other, from seizing hold of parts where the abstraction of blood would prove of little or no avail.

When the leeching is over, and the flow of blood has ceased, the perineum, anus, pubes, and hypogastrium should be kept constantly covered with flannel cloths, wrung out of a strong infusion of hops or opium. These applications are much preferable, in every respect, to emollient poultices, which not only frequently oppress by their weight, but soon become dry and disagreeable. Indeed, they may be

considered both here and in cystitis as among our most valuable adjuvants; they relax the parts, promote perspiration, and relieve pain and spasm.

The pain and straining, which so commonly attend this malady, are often promptly relieved by the use of an anodyne enema. The same rules should be observed here, in respect to the administration of this remedy, as in cystitis and spasmodic retention of urine. When the irritation of the bowel is too great to enable the rectum to retain the injection, an opiate suppository will form a valuable, if not an indispensable, substitute.

The internal use of opium will also be found highly valuable, especially after the inflammatory symptoms have been moderated by bleeding, antimonials, and laxatives. It should be exhibited in full doses, every six or eight hours, either alone or in combination with four or five grains of calomel. The latter article I consider particularly important, in the subacute form of the malady, to assist in promoting the absorption of effused fluids, and modifying the action of the capillary vessels. It should however never be carried to the extent of ptyalism, and its effects, therefore, should be sedulously watched. When a diaphoretic and anodyne impression is indicated, Dover's powder may be usefully exhibited, but the dose should be considerably larger than under ordinary circumstances.

The condition of the bladder is early attended to, and retention of urine, so liable to occur during the progress of the complaint, is promptly relieved with the catheter. The instrument is handled with the greatest gentleness, and coaxed onward, if necessary, with the finger in the rectum. As the operation is always painful, and productive of spasmodic contraction of the parts about the neck of the bladder, it is a good plan always to exhibit, a few hours before it is attempted, a full anodyne enema.

Finally, absolute rest in the recumbent posture is indispensable throughout the whole treatment; the diet must be of the most bland and simple character; and the drinks must consist of gum water, linseed tea, slippery elm water, and other mucilaginous fluids. Nitrate of potassa and other stimulating diuretics are inadmissible, on account of their tendency to excite the renal secretion, and thereby increase the quantity of urine in the bladder.

SECTION II.

ABSCESS OF THE PROSTATE.

Acute inflammation of the prostate, if unsubdued, occasionally terminates in abscess. The event, however, is unfrequent, though the reverse, I am well aware, has been asserted by many writers. There may be a greater proclivity to this occurrence in the inhabitants of some countries than in those of others, growing out of their habits of life, the nature of their pursuits, and the influence of climate; and hence, when I assert that it is uncommon, I wish to be understood as having special reference to the people among whom I practise. A careful examination of the structure of the prostate is sufficient to convince any one that it is ill-adapted, if such an expression is allowable, to become the seat of abscess. In this respect, this organ may be said to bear a close resemblance to the uterus, liver, spleen, and pancreas.

Seat.—Any part of the prostate may become the seat of abscess,

Fig. 145.



and I am not aware that the occurrence is more frequent in one situation than it is in another. The middle lobe, however, is less liable to suffer than the rest of the organ, and often escapes entirely, even when the latter is nearly destroyed by it. The matter may be seated upon the surface of the gland, immediately beneath its

fibrous capsule, in its proper parenchymatous structure, or in its excretory ducts. Occasionally it exists simultaneously at all these points. In the annexed cut, the abscess was seated in the lateral lobe.

Number, Size, and Structure.—Abscesses of the prostate vary much both in their number and size. Sometimes, and this is what happens most frequently, there is only one, while at other times there are as many as six or eight, a dozen, fifteen, or even twenty, scattered through the substance of the organ, and giving it, when their contents are removed, a riddled, sieve-like appearance, not unlike that of the cribriform lamella of the ethmoid bone. Under such circumstances it is not unusual for several of them to commu-

minate together. When numerous, their dimensions are generally proportionably small, not exceeding, perhaps, the volume of a millet-seed or a pea. A solitary abscess of large size is sometimes seen. Sir Benjamin Brodie relates the history of one which contained at least half a pint of pus; the patient was an old man, and the matter escaped through the catheter after the urine had been drawn off. A similar case is mentioned by J. L. Petit;¹ and doubtless many others have occurred in practice.

When the abscess is of long standing, or slow in finding an outlet, it is generally, no matter what may be its size, surrounded by a cyst, of a pale-yellowish color, smooth internally, rough and flocculent on the outside, dense in texture, and from the fourth of a line to a line in thickness. The contents of such a *dépôt* do not differ essentially from those of a common phlegmonous abscess in other parts of the body. In general, they are of a light straw color, and of a thick, cream-like consistence, free from odor, and possessed of all the properties of laudable pus. Sometimes, however, they are more or less bloody, or sero-sanguinolent, and intermixed with lymph, mucus, and the debris of the affected gland. Occasionally, especially when it is long retained, the matter is excessively fetid.

The structures around the abscess are infiltrated with serous and other fluids, more or less softened, and of a brownish or reddish appearance, from the injected condition of their capillaries. When the purulent *dépôts* are numerous, they are sometimes entirely disorganized, and converted into a substance closely resembling wet tow. A common and almost a necessary effect of an abscess of the prostate is the formation of a cavity, which is often more serious in its consequences than the abscess itself.

Opening.—Abscesses of the prostate open in different directions, as the urethra and the bladder, the rectum, the perineum, and the peritoneal cavity. A knowledge of these circumstances is of no little importance in a practical point of view, and it is proper, therefore, that the subject should be considered somewhat in detail.

a. The most natural, though at the same time the most unfortunate direction, as it respects the affected structures, in which the abscess opens, is into the urinary bladder, or the orifice of the urethra, from which the matter is subsequently discharged along with the urine. Sometimes the abscess points and breaks almost simultaneously at both these situations. When it is bulky, a large

¹ *Œuvres Chirurgicales*, t. iii.

quantity of pus may thus be evacuated at once; or it may drain off slowly and almost imperceptibly. In the former case, the matter may be discharged in a pure state, or it may be mixed with the urine, which will then be of a lactescent, whitish, or grayish appearance, and perhaps more or less offensive; in the latter, the urine will exhibit little, if any, change, and deposit merely a thin, whitish sediment, visible at the bottom of the receiver.

b. The matter may be evacuated into the rectum, and be discharged either alone or in union with the feces. This mode of communication is by no means uncommon, and is almost certain to occur when the abscess is developed in the posterior part of the gland. The abnormal opening, situated at a variable height from the anal outlet, is generally within reach of the finger, and often continues fistulous a long time, permitting a ready interchange of the contents of the two reservoirs. The disease, in this case, is frequently complicated with inflammation and suppuration of the seminal vesicles and the adjacent structures.

c. In the third place, the pus may escape externally by inducing ulceration of the structures of the perineum. The progress of the fluid is indicated by excessive pain in the part, and by a hard, red, circumscribed swelling, which finally points, and breaks. In some instances the matter escapes into the surrounding cellular tissue, and extends upwards to the scrotum and even the penis, following the same course that the urine does when it is infiltrated into the perineum.

d. Finally, the abscess may burst into the peritoneal cavity, at the side or posterior part of the prostate, and so cause fatal inflammation. The occurrence, which is fortunately very rare, is announced by severe pain in the pelvic region, a small, quick, and contracted pulse, violent rigors, and rapid prostration of the vital powers. Death usually occurs in from thirty-six to forty-eight hours.

Such are the various points at which the matter of a prostatic abscess may ultimately find an outlet. Of these the first is, as previously stated, the most natural as well as the most frequent, but also at the same time the most undesirable one, as it involves a greater amount of risk to the patient, from the contact of the urine with the cavity of the purulent depôt after the escape of its contents. In this way an additional cause of inflammation is produced, which often operates to the destruction both of the part and the system. The passage of the matter across the perineum is uncom-

mon, though the contrary has been asserted by Sir Benjamin Brodie,¹ and is always attended with great delay and immense suffering, on account of the resistance offered by the fascia and muscles in this region. The escape of the pus through the rectum is unfortunate, as it frequently entails an obstinate fistule; but the most disastrous route of all is that in which the contents of the abscess pass into the peritoneal cavity, and excite fatal inflammation.

Age and Causes.—This disease occurs at all periods of life, though not with equal frequency. Young men and adults are most prone to it; on the contrary, it is very rare in childhood and old age. Mr. Mayo² records an interesting case of it in an infant of two years. The abscess was of large size, and communicated by a considerable orifice with the urethra. The exciting causes are the same as those of inflammation of the prostate, and need not, therefore, be re-enumerated in this place. It is not known what influence, if any, is exerted upon the production of this complaint by occupation, season, climate, and other circumstances. It is supposed by many, and not without reason, that chronic enlargement of the prostate, and an arthritic diathesis powerfully predispose to its occurrence.

Abscesses of the prostate are sometimes of a scrofulous nature. Very recently I observed an instance of this kind, in a lad about fourteen years old, a subject in the dissecting-room. He was very tall and slender for his age, and the abscess, which was less than a grain of coffee, occupied the posterior extremity of the left lateral lobe, and was filled with softened tubercular matter. The gland was, in other respects, perfectly healthy. No history of the case could be obtained. Scrofulous abscesses are necessarily chronic and insidious in their character.

Symptoms.—The formation of abscess of the prostate is not always announced by characteristic phenomena, and hence it not unfre-

¹ "The abscess, if left to take its own course, sometimes bursts internally, that is, into the urethra; more frequently it makes its way through the fascia, cellular membrane, and muscles of the perineum, and bursts through the external skin."—*Lectures on the Diseases of the Urinary Organs*, p. 112, second edition. London, 1835. Amussat asserts that abscesses of the prostate scarcely ever open spontaneously on the outside, or require the employment of the bistoury. The pus, he adds, most frequently enters the urethra, either in consequence of the efforts of the patient in urinating, or the introduction of the catheter.—*Lectures on Retention of Urine and the Diseases of the Prostate*, translated by Dr. Jervey, p. 86. Phila. 1840.

² *Outlines of Human Pathology*, p. 547. London, 1836.

quently happens that the first intimation which the patient and his attendant have of the real nature of the case is a sudden discharge of pus along the urethra, consequent upon the introduction of the catheter, or a violent effort at micturition. In general, however, when this event is about to take place, there is an increase of all the previous symptoms, both local and constitutional. The pain becomes exceedingly violent, and assumes an aching, throbbing character; there is a sense of weight and pressure at the neck of the bladder; the patient has almost a constant desire to void his urine, which is discharged with much difficulty, and either in drops, or in a small and feeble stream; the urethra is the seat of a scalding or burning sensation; the rectum feels as if it were distended by a foreign body; and more or less uneasiness is experienced in all the associated organs. In some instances the local suffering is of the most agonizing description, depriving the patient of appetite and sleep, and rapidly undermining the vital powers. Complete retention of urine occasionally supervenes. Along with these symptoms there are generally severe rigors, alternating with flushes of heat, intense thirst, excessive restlessness, high fever, and even delirium. When this combination of phenomena exists, there can hardly be any doubt about the nature of the case, especially if the individual has previously labored under acute or chronic prostatitis. An examination by the rectum will afford additional light, and will often detect fluctuation, more particularly if the matter occupies the posterior part of the gland. At an advanced stage of the complaint, the abscess may point in the bowel, or in the perineum, and thus remove all doubt respecting the diagnosis.

Prognosis.—Abscess of the prostate is generally to be regarded as a dangerous affection. The local suffering, if not promptly subdued by a natural or artificial outlet for the pent-up fluid, is of itself sufficient, in many cases, to bring on serious, if not fatal exhaustion. It behooves us, therefore, to be always guarded in our prognosis. Even under the most favorable circumstances, and where there is apparently little danger from the immediate ravages of the malady, the patient may fall a victim to its secondary effects. One of the worst consequences of this affection is a fistulous communication with the rectum, the urethra, the perineum, or urinary bladder, which it is sometimes impossible to heal, and which renders the individual alike uncomfortable to himself, and disagreeable to those around him. A large abscess is, of course, all other circumstances being equal, more dangerous than a small one, and a number of small

ones than a solitary small one. The prognosis, moreover, will be materially influenced by the patient's habits, his age, and his previous health.

Treatment.—In the treatment of this malady two important indications are presented; first, to limit the suppurative action, and secondly, to afford as speedy an outlet as possible to the effused fluid. To fulfil the first of these objects, prompt recourse must be had to depletion, provided this has not been already carried sufficiently far, to antimonials, diaphoretics, anodynes, and emollient applications. Leeches to the perineum and the lower part of the hypogastrium will often prove eminently serviceable, and can seldom be dispensed with. They should be applied in numbers varying with the age of the patient, the progress and intensity of the disease, and the nature of the previous treatment. For an adult, not less than twenty or twenty-five will be likely to answer the purpose; after they have dropped off, the flow of blood should be encouraged with cloths wrung out of warm water, and renewed every eight or ten minutes for several hours, unless signs of exhaustion appear, when it must be at once arrested. By these means, promptly and faithfully employed, the suppurative process is limited, the suffering subdued, and the abscess brought to a state of maturity.

The second indication to be fulfilled is the opening of the abscess; and the question therefore arises, are we justifiable in doing this? Not a few practitioners are of opinion that such collections should always be permitted to pursue their own course, on account of the uncertainty of distinguishing them, and the difficulty of reaching them with the knife. I cannot agree in the propriety of this advice. As long as the matter is pent up, the part is unrelieved, and the abscess has a tendency to increase and produce further mischief; nay, its contents may burrow extensively among the adjacent structures, doing great injury not only to them but also to the prostate, and finally, perhaps, escaping into the pelvic cavity; an event certain to be followed by fatal peritonitis. It is absurd to look upon an abscess of the prostate as a peculiar affection, for it does not differ from a phlegmonous abscess in any other part of the body, except by its situation, and there is nothing in this, I conceive, that should exempt it from ordinary treatment. The rule, therefore, which should be adopted in all cases of this disease, is to anticipate nature by an artificial opening, instead of allowing her to pursue her own wayward course; a course which is frequently tedious, ill-directed, and inadequate.

It has been already stated that the most favorable route for the escape of the matter is through the perineum, and hence, whenever it points in this direction, no time should be lost in furnishing it an outlet. For this purpose, a long, straight, narrow-pointed bistoury is much preferable to an abscess lancet, which is not only unsteady in the handle, but too short in the blade; even if it be pushed up as far its shoulders. The incision should be made in the most prominent part of the swelling, and care should be taken, on the one hand, to avoid the rectum, and, on the other, the urethra and urinary bladder. It must be quite free, and made as dependent as possible. A small tent may be retained in the track for a few days to prevent premature closure.

When the abscess points in the rectum, as will be indicated by the large size and fluctuating character of the swelling, it may be readily reached with a curved trocar, four or five inches long. The patient is placed as in the operation of lithotomy, and the left index and middle fingers, well oiled, are carried up the bowel until they come in contact with the most prominent part of the abscess. The trocar, concealed within its canula, is then placed in the groove formed by the junction of the two fingers, and as soon as it has reached its destination, it is thrust into the swelling, and immediately withdrawn, at the same time that the canula is pushed further in. When the matter is discharged, the instrument is removed, and the case is treated upon general principles. For some days after the operation, the lower bowel should be kept as quiescent as possible.

When the abscess bulges inwards towards the urethra and the neck of the bladder, it may be punctured with a common silver catheter, carried down in the usual way, and moved about in different directions, as in searching for a urinary calculus. Or, instead of this, a sound with a conical beak and a small curve, may be used, and this, on the whole, is preferable, inasmuch as it can be made to pierce the abscess with more facility. The slightest pressure frequently suffices to effect our object. When the abscess is not yet completely matured, and the local suffering is such as to render delay improper, the operation may be executed with the lancetted stylet used for dividing strictures of the urethra. When, by any of these procedures, the matter has been evacuated, the urine should be frequently drawn off with the catheter, to prevent its entrance and sojourn in the interior of the sac; an occurrence not only productive of exquisite pain and spasm, but liable to be followed by the worst consequences as it respects the recovery of the affected

gland. When the parts are tolerant of the presence of the instrument, it may be permanently retained in the urinary passages, until all danger from the above cause is past.

When the abscess is of a scrofulous character, as indicated by the nature of the pus, the system should be subjected to the influence of iodine and tonics.

SECTION III.

ULCERATION OF THE PROSTATE.

Ulceration of the prostate is of such infrequent occurrence, and of such difficult recognition, that if it were not for my desire to present a full and connected view of the maladies of this organ, I should hardly deem it necessary to allude to it here. The lesion was first described by Sir Everard Home, in his monograph on the Diseases of the Prostate Gland, published in London in 1811; but, with the exception of Vidal, no writer on surgery has considered it of sufficient importance to incorporate an account of it in his work. Civiale has devoted a short chapter to it in his Treatise on the Urinary Organs, consisting chiefly of a repetition of the observations of the English surgeon.

Causes.—The disease is induced by various causes, of which the principal are, the presence of calculous concretions in the substance of the organ, wounds, or lacerations, whether by accident or the forcible employment of instruments, and the formation and evacuation of abscesses. Of these, the first and third are doubtless the most common. Wounds of the prostate, whether incised or lacerated, generally heal in a short time, either by the first intention, or by the granulating process. It is only in rare instances that they are followed by ulceration, or sloughing. When stones exist in the gland in considerable numbers, they gradually produce absorption of the adjacent parenchymatous textures, and thus lead to the formation of corresponding ulcers. If the irritation continues, the intervening septa are gradually broken down, and a large cavity is the result. A single concretion, especially if of large size, occasionally causes similar effects, and may even lead to perforation of the rectum or perineum. The evacuation of an abscess is necessarily followed by an ulcer, which, serving as a receptacle for the urine, remains open for a great length of time, if, indeed, it ever heals. In the tubercular form of the affection, a considerable number of ulcers occasionally ensue from the bursting of the

purulent depôts, which are frequently quite numerous. The lesion may occupy the entire gland, or be confined to a particular part. The middle lobe, when in a state of enlargement, suffers perhaps quite as frequently as any other portion. Sometimes the ulcerative process begins simultaneously at several points, which, gradually increasing, finally coalesce, and thus form one large cavity. When the result of abscess, a prostatic calculus, or a slough, the ulcer is generally ragged and irregular, and becomes lined in time by an organized false membrane.

Symptoms.—The symptoms which accompany ulceration of the prostate are such as indicate the existence of chronic disease of this organ and of the neck of the bladder. The patient has a frequent desire to make water, the passage of which is attended with a scalding sensation along the urethra, and more or less spasm and tenesmus; there is severe pain in the region of the affected part, of a sharp, burning, or lancinating character, and darting through the neighboring parts; constant itching and uneasiness are experienced in the head of the penis; and the urine, which is voided perhaps every half hour, is more or less turbid, and loaded with a thick, glairy, ropy mucus. Occasionally there is a discharge of blood, variable in quantity, as well as in regard to the frequency of its recurrence. The local symptoms, in fact, generally strongly simulate those of vesical calculi. In the progress of the disease, the constitution necessarily suffers; the digestive organs become deranged; the flesh wastes; the countenance is wan, thin, and haggard; the pulse is small and irritable; and the patient, worn out by the loss of sleep and physical suffering, gradually falls into a state of marasmus, from which he is destined never to recover.

"The best distinguishing mark," says Sir Everard Home,¹ "which I have learned, from experience, of a diseased state of the prostate gland, is the viscid mucus mixed with the urine. This mucus, I am convinced, is produced entirely from that gland, and is met with whenever its functions are much disturbed. The occasional appearance of this mucus is a consequence of every attack of inflammation from whatever cause; but when it continues without abatement, whatever mode of life the patient follows, and whatever medical treatment is adopted, and lasts for months, there is no doubt of a permanent disease having taken place in the gland; either an ulcerated state of the surface of the middle lobe, of one of the lateral lobes, or an ulcer in the substance of the gland." The intro-

¹ *Op. cit.* p. 234.

duction of the catheter is always attended with excessive pain, and an aggravation of the local distress; pressure on the perineum, and the insertion of the finger into the rectum, produce similar effects. In the more violent forms of the affection, the patient finds it impossible to remain long in the erect posture, or even to sit on a chair; all active exercise, in fact, is impracticable. Perhaps the most reliable circumstances, in a diagnostic point of view, are, the absence of vesical calculi, long-continued suffering in the neck of the bladder, a constant secretion of thick, glairy mucus, a frequent desire to void the urine, and an occasional discharge of blood.

During the progress of this affection, disease is apt to be awakened in the other parts of the urinary passages. The bladder and urethra become inflamed, tender, and exquisitely irritable, and occasionally even the seat of ulcerative action. The ureters and kidneys are also sometimes liable to suffer; the urine is changed in its properties; and calculi occasionally form in the bladder; thus greatly complicating the case. The testicles often become tender, hemorrhoids form around the anus, and the bowel descends during micturition.

It need hardly be said that the affection under consideration is one of an exceedingly grave character. The chief danger arises from the function of the parts, and the constant presence of the urine, which, fretting and irritating the affected surfaces, prevents them from cicatrizing. Hence, the disease is always intractable, and seldom fails to prove fatal. The period at which this event occurs varies from a few months to several years.

Treatment.—The treatment of ulceration is altogether unsatisfactory and empirical. Attention must be paid to the general health, by regulating the diet, the bowels, and the secretions; the warm bath should be used from time to time; the patient should avoid exercise and the erect posture; pain should be allayed by opiates; the bladder should occasionally be washed out with tepid water, either simple or medicated; and the affected surfaces should be lightly touched once every five or six days with a weak solution—ten grains to the ounce—of nitrate of silver, applied with a piece of soft sponge, projected from a silver canula. If the pain, scalding, and spasm are great, leeches and counter-irritation will be beneficial. The best internal remedies are balsam of copaiba, cubebs, and spirits of turpentine largely diluted with demulcent fluids.

The following case, for the particulars of which I am indebted to the politeness of Dr. Bowen, curator of the Pathological Museum

of the New York Hospital, affords a well-marked example of ulceration of the prostate, but whether the disease began in this organ, or in the urethra or bladder, it is impossible to determine. The preparation, marked 660, is described as one of chronic cystitis and pyelitis.

John Johnson, aged 35, seaman, was admitted January 24, 1850, for supposed stone in the bladder. None, however, was found upon sounding. He had the aspect of a person suffering from serious organic disease; he was emaciated and very feeble, and had a small, weak pulse, without any acceleration, and a cool skin. There was no hectic. He had a frequent desire to pass his water, attended with pain and scalding, especially in the posterior part of the urethra. The flow of urine was sometimes free, sometimes obstructed; the region of the bladder felt tender on pressure; and there was occasionally a sharp, lancinating pain in the testicles, which were often very much retracted: the left one was slightly enlarged, and some tenderness extended along the corresponding cord. There was no pain or suffering in the region of the kidneys. The urine was of a deep red color, slightly acid, and of the specific gravity of 1.020, but of normal quantity. After standing a short time, it deposited a copious sediment of pus and blood. The patient stated that about a year before his admission, he first experienced a scalding sensation in passing his water, with a diminution of the stream; that he never had gonorrhoea or any other venereal disease; and that the introduction of a bougie was followed by a discharge of bloody urine, which continued for two or three weeks. The stream of urine was sometimes natural, sometimes lessened, and sometimes obstructed by stringy mucus. The patient had a tendency to diarrhoea, and gradual exhaustion of the vital powers. There was no evidence of renal disease. Under the influence of carbonate of potash, the suffering decreased, until the urine became alkaline, when the pus was replaced by a stringy mucus, which sometimes obstructed the urethra. The urine gradually lost its bloody appearance, and its specific gravity fell to 1.012. After the alkalies were discontinued, it gradually regained its acid properties. The diarrhoea was checked for a time, but soon returned; the dejections being of a peculiar orange color, without mucus or blood. Suppression of urine came on two days before death, which happened on the 15th of March.

An examination of the body revealed the following facts: The intestines were united to the bladder, the left ureter, kidney, and spleen, by old and firm adhesions, and all, except the latter, were

imbedded in a thick, dense layer of organized lymph. The convex surface of the liver was glued to the diaphragm by recent effusion. The urethra, laid open along its dorsal surface, presented nothing unusual, except a slight, slaty discoloration, and an unnatural degree of vascularity. At the posterior extremity of the membranous portion, the walls suddenly ceased by a well-defined ulcerated edge, the tube terminating in a large cavity, capable of containing an ounce of fluid, and lined by an organized false membrane. The cavity occupied precisely the situation of the prostate gland, of which not a vestige could be perceived. About an inch in front of the cavity, and extending some distance along the urethra, was a dense, firm texture, which was evidently the remains of a stricture. Beyond the cavity, the neck of the bladder was distinguishable, but greatly deformed by irregular ulceration; its muscular fibres being hypertrophied and ragged. The cavity of the bladder contained at least half a pint of pus; it was preternaturally small, and had lost its proper shape. It exhibited a dark red appearance, and was completely deprived of mucous membrane. The muscular fibres were hypertrophied, dark red, brittle, and everywhere exposed as if they had been dissected. Here and there they were destroyed by ulceration. The peritoneal coat was inseparably united by a thick, false membrane with the surrounding parts. Immediately upon the fundus of the bladder, and limited by firm adhesions, was an abscess, of about the diameter of the large intestine. From this point it extended upwards and over towards the left side, following the course of the ureter, and terminating behind the left kidney, about its middle. It was evidently of ancient origin, had organized walls, and was capable of containing fully a pint of matter. While examining the cavity of the abscess, the left ureter, enlarged and thickened, could be plainly seen, just above its middle portion, and on its anterior surface, to communicate with the abscess by an irregular opening, half an inch in length. The canal was perfectly free in its entire extent. The left kidney, invested by a thick, firm, false membrane, was of the natural volume. On incising the organ, a quantity of thick pus gushed out, and its tubular structure was found to be nearly destroyed. The cortical structure was healthy. The right kidney was sound. The lungs contained some miliary tubercles. All the other organs were in a natural state.

It is impossible, as already stated, to determine, from the history of this interesting case, where the disease commenced. The proba-

bility is, as Dr. Bowen has suggested in his comments respecting it, that the patient, although he denied it, had gonorrhoea, terminating in stricture, and this, in its turn, in inflammation, which gradually extended to the prostate gland, and from thence to the bladder, the peritoneum, the left ureter, and kidney, producing the ravages which were revealed by the dissection.

CHAPTER III.

HYPERTROPHY OF THE PROSTATE.

HYPERTROPHY is an augmentation of the volume of the prostate, produced by increased nutrition of its constitutional elements. There are several forms of it, but the most common by far is that to which the term *senile* has been applied, from its being a frequent accompaniment of old age. Until the latter part of the last century, this affection was very imperfectly understood. Muralt, Bartholin, Bonnetus, Morgagni, Sandifort, Herhold, and others, indeed, had each seen and described cases of it; but it had not particularly arrested their attention, nor led to any valuable practical inferences. It was reserved for John Hunter to throw new light on this subject. In his "Treatise on the Venereal Disease," issued in 1786, he gave a succinct but graphic account of it, pointed out its principal effects upon the urinary apparatus, and spoke of the means best adapted for relieving it. The picture thus drawn by this illustrious master was subsequently most ably filled up by his nephew, Sir Everard Home, whose monograph on the "Treatment of the Diseases of the Prostate Gland" appeared in London in 1811, and comprises the most elaborate body of facts that has ever been published on the subject. Since that period, the malady has attracted general professional attention, and has been described, though seldom with any minuteness, in most systematic treatises on surgery. Very recently, valuable contributions to this department of pathology and practice have been made by Mercier and Civiale, of Paris, in their works on the genito-urinary organs. Sir Benjamin C. Brodie has also published some excellent observations upon the subject.

Seat.—Hypertrophy may occur in any part of the prostate, and exist in various degrees. Most commonly it affects the entire gland,

though not uniformly. It has been very generally believed, in consequence, probably, of a statement of Sir Everard Home, that the left lobe is more frequently involved than the right. The opinion, however, is not borne out by the results of dissection; and no reason, anatomical, physiological, or pathological, can be assigned for the occurrence, supposing it to exist. My own experience does not enable me to settle the question; a circumstance which I regret so much the less, because, practically considered, it is really of no importance one way or another. In nearly all cases, when the hypertrophy has made considerable progress, both the lateral masses are implicated; not necessarily, however, in the same degree. Occasionally the lesion is almost exclusively confined to the third lobe, and that too, perhaps, when the enlargement is so great as to cause retention of urine, and, ultimately, the patient's death.

Degree and Form.—The hypertrophy exists in various degrees, from the slightest augmentation of the natural volume of the prostate to the dimensions of a pullet's egg, a walnut, or a medium-sized orange. In rare cases, indeed, it may even considerably exceed the latter dimensions. Bartholin records an instance in which the gland is said to have equalled the size of a man's head; but this is evidently an exaggeration, as is proved by the fact that the pelvic cavity is incapable of containing a body of this magnitude. The greatest increase of volume usually occurs in the long axis of the organ, in consequence, no doubt of the want of resistance in this direction. Under these circumstances, the lateral lobes are of an elongated, oval shape, generally larger in the middle than at the extremities, convex in front, and rather compressed behind. When, on the contrary, the hypertrophy advances equally in all directions, these bodies will be apt to be somewhat obround, or like the half of an orange. Enlargement of the gland in front and below is opposed by the elevator muscles of the anus, the deep perineal fascia, and the pubic bones. Occasionally the organ increases more in the transverse than in the vertical diameter, extending outwards towards the sides of the pelvis, and thus overlapping and compressing the rectum. The adjoining engraving, Fig. 146, from a specimen in the collection of Dr. Sabine, of New York, represents the prostate greatly enlarged in every direction, and of a flattened, cylindrical shape. The size is reduced one-half.

When the lateral masses are equally enlarged, they frequently project inwards towards the median line, so as almost to touch each other. This occurrence, however, is rare, and is met with only in

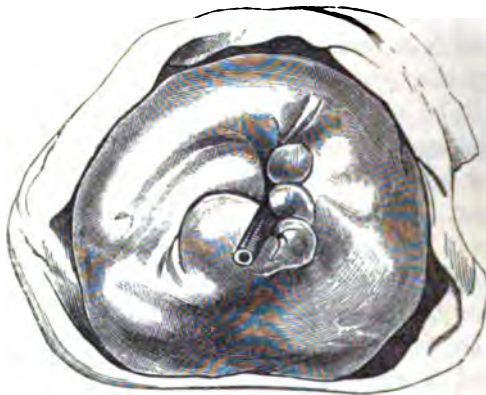
the more aggravated forms of the malady. More commonly there is a small interval between them, representing the appearance, when the gland is laid open longitudinally along its pubic surface, of a median groove or gutter. When one lateral lobe is more enlarged than the other, the more bulky one frequently encroaches more or

Fig. 146.



less upon the smaller one, and thus produces a lateral curvature, or a change in the direction of the neck of the bladder and the commencement of the urethra. Again, it occasionally happens that one

Fig. 147.



lobe projects over on one side, and the other lobe on the opposite, giving rise thereby to two curvatures instead of one, as in the former case.

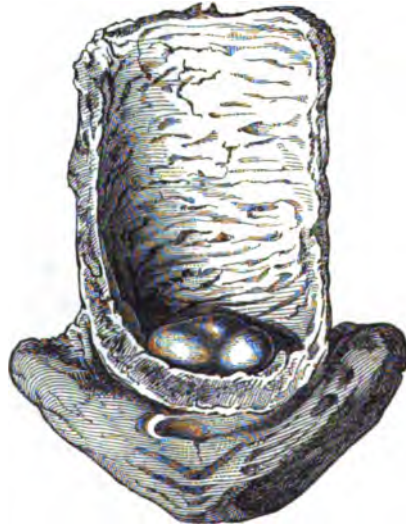
Whatever may be the shape of the enlarged masses, or the direction in which the hypertrophy occurs, their surfaces, both external and internal, may be perfectly smooth, or they may be more or less irregular, knotty, and even lobulated. Sometimes small prominences exist upon them, attached by a broad base, and evidently prolonged from their substance, which they resemble in color and structure. Fig. 147, from a specimen in my collection, exhibits this form of the enlargement. Several such bodies are occasionally found close together, thus producing a lobulated appearance. Cysts sometimes form in the enlarged masses, from the size of a pea up to that of a large marble, filled with serous fluid, and lined by a sort of false membrane. Finally, the surface of these bodies has been found excoriated, fissured, and even ulcerated.

When the *middle lobe* is hypertrophied, it generally forms a sort of mammillary process, which is more or less vertical in its position, and varies in size from that of the female nipple to that of a pullet's

Fig. 148.



Fig. 149.



egg, Fig. 148¹ and Fig. 149. The apex of the tumor is free and rounded, while the base is immovably fixed, and rests as it were upon

¹ From a specimen in the private collection of Professor Mott, in the College of Physicians and Surgeons of New York. It may be stated here that all the figures, illustrative of enlargement of the prostate, are original.

the posterior extremity of each lateral mass. Its position is usually median; but sometimes I have found it to project more to one side than the other, and thus create an additional impediment to the introduction of the catheter. Although the form of the third lobe, when hypertrophied, is generally as here represented, cases occasionally occur in which it is exceedingly irregular, setting everything like accuracy of description at defiance. Next to the mammillated variety is, according to my own observation, the triangular, in which the tumor is large behind and narrow in front, terminating in a tolerably sharp crest. More rarely it is of a rounded shape, or broad and convex on its free surface, and adherent by a small pedicle. I have seen specimens in which the swelling consisted of three oblong bodies, placed side by side, as in Fig. 150, from a specimen in my private cabinet; and examples are recorded in

Fig. 150.



which there were as many as four and even five such lobes. Whatever be the form and volume of the tumor, it always projects towards the bladder, drawing up the prostatic portion of the urethra, and elongating the verumontanum.

Consistence.—The consistence of a hypertrophied prostate is liable to considerable diversity, and occurs under two very opposite forms, the hard and the soft. In the first, the more frequent of the two, the induration varies from the slightest increase of the natural consistence to the firmness of the fibrous tissue. It was owing no doubt to this circumstance that the older pathologists were so con-

stantly in the habit of considering this affection as being of a scirrhous character; an error, perhaps, not entirely exploded at the present day. When the induration exists in a high degree, the affected part tears with difficulty, and offers considerable resistance to the scalpel, but does not yield a crepitating sound. Interspersed through its substance are numerous granulations, of a grayish color, rounded or oval in their shape, and hardly as large as a millet-seed. They are inclosed each in a cellulo-fibrous capsule, to which they adhere by a delicate pedicle, and from which they may be easily enucleated. A section of the gland exhibits a rough, irregular surface, caused by the manner in which the granulations project from the cells or lodges in which they are naturally embedded. By pressure, a thin, milky fluid is obtained from it, which is probably merely the prostatic liquor, somewhat altered in its properties and slightly increased in quantity.

In the soft variety, the enlargement proceeds in a more uniform manner, and attains, as a general rule, a greater magnitude than in the hard. The affected tissues are more or less elastic, and yield readily under the pressure of the finger. The granulations are larger and more conspicuous than in the first variety, are of a soft, spongy texture, and of a whitish or grayish aspect. By a little care they can be easily separated from their cellulo-fibrous capsules, when it will be found that their principal bond of union is a delicate pedicle, through which they receive their bloodvessels, nerves and lymphatics. Their shape is the same as in the hard variety, and the fluid which exudes from them on pressure is a little more abundant, and of an opaque, milky, yellowish, or brownish hue.

The nature of the granulations above described is not well-ascertained. It is highly probable, however, that they are nothing but the terminal follicles of the prostate, in a state of enlargement and partial occlusion. The capsules in which they are inclosed are of a dense, fibrous structure, and are evidently formed out of the natural fibrous element, very much hypertrophied. The lesion bears the greatest analogy to cirrhosis of the liver, so ably described by Laennec, Carswell, and other pathologists.

Color.—From the remarks made on the structure of the prostate in a previous section, it would appear that its color varies in the different periods of life, from circumstances directly dependent upon its nutritive functions. In senile hypertrophy, which generally takes place under the influence of causes operating in a slow and gradual manner, there is usually a diminution of color, in conse-

quence, apparently, of the concomitant compression of the capillary vessels which ramify through the substance of the organ. Hence, if a section be made of the parenchymatous structure, the surface will be seen to be of a dull grayish, light ash, or pale drab tint, and to emit hardly any blood on pressure. When the hypertrophy is produced and kept up by irritation, there is sometimes an increase of color, and an augmented capillary circulation. Under such circumstances, the parenchymatous substance may exhibit various shades of red and brown, and afford a considerable quantity of blood under pressure and maceration.

Weight.—The weight of a hypertrophied prostate is necessarily augmented in all cases. In the adult, as was before stated, the average weight is from three to five drachms. In the affection under consideration the increase of weight ranges from a few grains to several drachms. In the more aggravated forms, it sometimes amounts to several ounces. Ford¹ relates an instance in which the organ weighed nine ounces.

Causes.—Hypertrophy is always produced under the influence of causes which act in a slow and permanent manner. When the operation of the exciting agent is brief and transitory, the result is merely a temporary enlargement, from which the organ gradually recovers by its own energies as soon as the irritation which awakened it is removed. Habitual engorgement acts in the former manner, and may, therefore, be regarded, in all cases, as the immediate cause of the affection. Augmented action necessarily occasions an augmented afflux of blood, and a corresponding increase of nutrition. Diminished action has a reverse effect.

A great variety of causes, some of them real, and others imaginary, have been assigned as being capable of producing this disease. Amongst the former have been generally enumerated excessive venery, stricture of the urethra, disease of the bladder, horseback exercise, gonorrhoea, and the employment of stimulating diuretics.

That protracted and frequently-repeated sexual intercourse is capable of inducing hypertrophy of the prostate is unquestionable; but that the lesion is often excited in this way is a point which remains to be established. Men with enlarged prostates are, it is well known, frequently exceedingly lecherous, from an extension, probably, of irritation to the ejaculatory ducts and the seminal vesicles:

¹ London Med. and Phys. Journ. March, 1802.

and hence what has so commonly been regarded as a cause may, in reality, be merely an effect of this disease. Be this as it may, hypertrophy occasionally exists, and that in a high grade, in persons who have led a life of the most perfect chastity. The case of the late Dr. Fothergill, of London, is one in point. This celebrated physician, who had labored for many years under this distressing malady, declared on his death-bed that he never in his life had had sexual intercourse.

Stricture of the urethra has been very commonly accused as an exciting cause of this disease, but with what justice is still a mooted question. Sir Everard Home¹ is of the opinion that the lesion is frequently induced in this manner, but unfortunately his assertion does not seem to be supported by positive facts. In the few examples which came under his observation, the prominent symptom was difficulty of micturition; but he has afforded us no means of judging, except in a solitary instance, whether this depended exclusively on the stricture or not. In the latter case, the patient, who was seventy-six years old, died, and the prostate was found enlarged in its whole extent. No post-mortem examination was made in any of the other patients. Civiale² declares that the prostate is usually healthy in persons affected with permanent stricture; and he adds that the same thing frequently happens from other disorders giving rise to retention of urine. Mercier³ thinks that stricture of the urethra, so far from being a cause of hypertrophy of this body, is generally calculated to produce an opposite effect. The pressure which the accumulated urine constantly exerts upon the gland, under such circumstances, impedes its capillary circulation, and also, as a necessary consequence, its nutrition. My own experience fully corroborates the conclusion of the French surgeons, and I am, therefore, inclined to believe that, when the two affections occur together, they should be viewed in the light, not of cause and effect, but merely as coincident disorders. I have seen quite a number of cases of stricture in old men in whom the prostate was little, if at all, enlarged.

A considerable hypertrophy of the prostate is occasionally developed under the influence of the irritation resulting from the presence of a vesical calculus. That cases of this kind are not

¹ Practical Observations on the Treatment of the Diseases of the Prostate Gland.

² *Traité des Maladies de l'Urèthre*, p. 116.

³ *Op. cit.* p. 205.

uncommon is a matter of daily observation. The affection thus produced is sometimes noticed at a very tender age, and is sufficiently frequent in old subjects. The irritation upon which the hypertrophy in such cases depends may originate either in the gland itself, or it may be propagated to it from the urinary bladder. In either event, it is followed by an increased capillary circulation, and a corresponding augmentation of the nutritive function.

Another very common cause, as is supposed, is horseback exercise. This is always attended with a rapid succession of shocks of the pelvis and pressure of the perineum, and is liable to be followed by venous congestion of the prostate. This idea is certainly plausible, but it labors under the disadvantage of not being sustained by a solitary proof. I am acquainted with a great many country physicians, clergymen, sheriffs, constables, and collectors, who are in the daily habit of riding on horseback, and yet are wholly free from this affection. I am not aware that cavalry men and dragoons are more obnoxious to it than other persons.

Velpeau, Acton, and several other writers lay much stress upon gonorrhoea as an exciting cause of this lesion, and there is no doubt that it often leads to this result. The specific disease frequently extends to the posterior part of the urethra and even to the neck of the bladder, where, if it is permitted to remain for any length of time, it is very apt to produce permanent engorgement of the prostate, followed by hypertrophy of its parenchymatous structure. The gland appears in this case to suffer from an extension of the disease in the same manner as the testicle sometimes does. This form of the lesion occasionally exists at a comparatively early age, and that, too, in a high degree.

It has not been ascertained to what extent, if any, the prostate is liable to be influenced by constitutional syphilis. It may be supposed, however, that, like the testicle and spermatic cord, it may suffer in the secondary and tertiary forms of this malady; a conjecture which derives countenance from the fact that this organ is traversed by the ejaculatory ducts, in their passage towards the urethra. At all events, it is well enough always, in chronic enlargement of the prostate, to inquire particularly into the patient's habits, and if the two diseases are found to coexist, to treat the case accordingly.

Finally, the protracted or frequent use of stimulating diuretics, of wine, and alcoholic drinks; exposure to cold; the repulsion of cutaneous diseases; gout and rheumatism; external violence; the

frequent introduction of the catheter; and habitual straining at stool, as in chronic diarrhoea and other affections of the bowels; may all be enumerated as so many exciting or predisposing causes of this affection.

Period of Life.—Hypertrophy of the prostate is emphatically a disease of old age. While all the other organs of the body, almost without exception, experience a diminution of weight and bulk as man approaches the period of decrepitude, the gland in question alone manifests a tendency to transcend the limits assigned to it by nature. No observations that have yet been made afford a clue to this singular circumstance. The senile form of the lesion rarely takes place, at least, in any considerable degree, before the age of fifty, fifty-five, or sixty; slight manifestations of it are occasionally met with at forty-five, and indeed, even at forty; but this is exceedingly rare, and constitutes an exception to an important general law. The affection is not unfrequently witnessed in old men of seventy, seventy-five, and even eighty; but when this is the case, the probability is that it commenced much earlier, and now shows itself, for the first time, by appropriate symptoms. "When the hair," observes Sir Benjamin Brodie,¹ "becomes gray and scanty, when specks of earthy matter begin to be deposited in the tunics of the arteries, and when a white zone is formed at the margin of the cornea, at this same period the prostate gland usually, I might perhaps say invariably, becomes increased in size." This view, I am inclined to think, is more poetical than real. The belief, I know, is very general, even in the profession, that there is hardly a man of fifty who has not an enlarged prostate. My experience has supplied me with no facts in support of this opinion. The conclusion is too sweeping. The word "old" is a relative one, and should be used in no other sense in reference to the present subject. Thus, one man is old at forty, another at fifty, another at sixty, and another, perhaps, not until he is seventy. Gray hair, earthy specks in the coats of the arteries, and a zone around the cornea, are no signs of old age, physiologically and philosophically considered.

Hypertrophy, not the result of old age, may occur at any period of life, under the influence of inflammatory excitement and vascular engorgement. I have observed cases of it from this cause in subjects under five years of age, and others have met with it still earlier. It is most common, however, in middle life, from an

¹ Lectures on the Urinary Organs, p. 118, second edit., 1835.

extension of gonorrhoeal inflammation and other sources of permanent irritation.

Progress.—Senile hypertrophy generally advances very tardily, and hence a long time often elapses before the gland attains such a bulk as to lead to serious inconvenience. In many cases, indeed, after having acquired a certain magnitude, its progress is arrested, and the organ remains stationary for several years, if not during the rest of life. The inflammatory form, on the contrary, is usually more rapid in its march, and may attain a considerable height in a few months. It is also less persistent than senile hypertrophy, and is more amenable to treatment.

Symptoms.—This change in the condition of the prostate is usually very insidious in its mode of invasion and the circumstances attending its progress. No symptoms indicative of its seat or peculiar character show themselves until long after the mischief has commenced. Its march is not only slow, but eminently stealthy and deceptive. The affection, in a word, is chronic from its inception, and cannot, without great difficulty and circumspection, be distinguished, in its earlier stages, from chronic disease of the bladder and the urethra.

Irritation at the neck of the bladder, and a frequent desire to pass the urine, are the symptoms which generally first attract the attention of the patient. From the mildness, however, of their character, they rarely create any unpleasant apprehensions, and the real nature of the disease, therefore, is often overlooked at a time when a knowledge of it is of paramount importance. By degrees other troubles are added, and it is in this manner that he is finally brought to a full sense of his situation. The distress at the neck of the bladder becomes more constant, as well as more severe, and there is not only a frequent desire to void the urine, but great difficulty in starting it. The stream also is unnaturally feeble; and, instead of being projected in the form of an arch, as it is in the healthy state of the parts, it falls perpendicularly from the urinary orifice between the patient's feet, or upon his shoes. Slight pain is felt along the urethra, accompanied by a burning, smarting, or scalding sensation in the head of the penis, and a free discharge of prostatic fluid. In consequence of the frequent and violent straining which attends the process of micturition, hemorrhoids, hernia, and prolapsion of the bowel are apt to occur; and, for the same reason, the feces are liable to be voided simultaneously with the urine. The mucous membrane is sometimes habitually everted at the verge of the anus, and

exhibits itself in the form of a red, tender fold, which is constantly irritated from exposure to the atmosphere, the contact of acrid secretions, and the pressure of the adjacent parts. The rectum never feels entirely empty, even after the most thorough purgation, but as if it contained a lump or ball, and the feces are often passed in a flattened form, especially if they happen to be of a solid consistence. At night the patient is disturbed by an involuntary discharge of seminal fluid, or he is perhaps harassed with erections without emissions. This phenomenon occasionally exists in very old men, and adds greatly to the local distress. The testicles sometimes sympathize with the affected gland, becoming very tender, and even enlarged. In two cases, I have found the disease associated with hydrocele on the left side. Hernia may also be produced by the straining which attends the disease.

Such are the symptoms which denote the existence of this disease in its earlier stages, and in its milder forms. As it advances, they become more and more aggravated, though they are still essentially the same in character. The desire to urinate increases in frequency; the bladder is less patient of its contents; the pain is more severe and constant, as well as more extensively diffused; micturition is attended with greater difficulty; and the prostate is the seat of a constant soreness. The general health, which until now was, perhaps, tolerably good, gradually declines; the appetite fails; emaciation ensues, and the sufferer, obliged almost incessantly to make water, obtains hardly any sleep. The constitution, assailed by an enemy that gives it no rest, is at length exhausted; the pulse is small and feeble; the surface is dry and hot, or bedewed with a cold, clammy sweat; the feet are oedematous; the teeth are incrustated with sordes; the tongue is dry and black; and the patient falls into a state of coma, from which he is destined never to awake. Such is the course of a disease, which, in the amount of distress it entails, is one of the most frightful in the whole catalogue of nosology. Truly, "the pitcher is broken at the fountain, and the wheel at the cistern."

The pain which accompanies this affection varies in different individuals, and in the same person under different circumstances. It is not in proportion to the size of the organ, but to the difficulty in expelling the urine. It is generally felt most keenly at the neck of the bladder, in the urethra, and at the head of the penis. It is increased by exercise, the erect posture, the pressure of the urine, and by sexual intercourse. In most cases, it extends to the sur-

rounding parts, as the perineum and the anus, the testes and spermatic cords, the sacrum, loins, thighs, and groins. It may be dull, heavy, or aching; throbbing or pulsatile; hot, scalding, or burning; or sharp and darting, as in neuralgia. Very often it is of a spasmodic nature, and is accompanied by the most violent tenesmus. The patient sometimes complains of a "bruised feeling," or of a sense of soreness, at first in the perineum, and afterwards about the anus, in the thighs, and groins.

A very unpleasant symptom of this affection is a sense of weight or fulness in the pelvis, and a feeling as if the bladder were never entirely empty. This evidently arises from two circumstances: first, from the pressure of the enlarged gland itself, and, secondly, from the presence of a certain quantity of urine, which is never wholly expelled, no matter how violent may be the efforts made for that purpose. The fluid which is thus retained is soon decomposed, and thus becomes a source of irritation both to the bladder and the affected gland.

The urine, at first perfectly clear, and, to all appearance, natural, becomes gradually changed in its properties, and sometimes even in its quantity. It is generally thick, fetid, acrid, and highly alkaline: depositing, upon standing, a great abundance of thick, ropy mucus, often streaked with phosphatic matter, and always firmly adhering to the bottom of the receiver. The fluid is soon decomposed—indeed it is frequently so before it is voided—and then always exhales a strong ammoniacal odor. Its color, in cases of long continuance, is commonly more or less dark. When hypertrophy is accompanied by ulceration of the prostate, it is sometimes tinged with blood. The quantity of urine may be natural, increased, or diminished. In general, I have found it to be somewhat increased, but this was probably owing to the quantity of the patient's drink, rather than to the direct influence of the local disease upon the kidneys.

The urine, which is at first discharged only six or eight times a day, is at length voided every hour, every half hour, or even every ten, fifteen, or twenty minutes. During the act of micturition, the patient is obliged to straddle his legs, to bend his body forwards, and to make the most violent muscular efforts in order to accomplish his purpose. He strains and presses, in fact, with all his might, as if he were determined to expel not only his urine, but his bladder along with it. During these exertions his feces frequently escape into his pantaloons, and the bowel descends several inches below the anus; his face is flushed, and his eyes look as if they

were ready to jump from their sockets. At last, after months and years, perhaps, of the most horrible suffering, the urine is either retained, or has to be drawn off constantly with the catheter, or it dribbles away incessantly, the sphincter being no longer able to perform its office. In general, the incontinence of urine is conjoined with retention; for, as was before stated, the bladder is rarely, if ever, wholly emptied, on account of the increased size of the prostate and the cul-de-sac which the former organ presents behind the latter.

The constitutional symptoms of this disease, like the local, are dependent rather upon the amount of sympathy manifested by the surrounding parts than upon the degree of enlargement of the prostate. In the earlier stages there is little or no fever, and perhaps, in truth, little or no disorder of any kind. As the disease progresses, however, the health manifestly suffers; the tongue is coated, the pulse is irritable, the sleep is disturbed by unpleasant dreams, the skin is inclined to be dry, the feet are cold in the day and hot at night, the appetite is deranged, the bowels are irregular, and the urine is acrid and high-colored, at times scanty, and at other times preternaturally abundant. These symptoms, as well as the local, are liable to temporary aggravation from exposure to cold, exercise on horseback, venereal indulgence, stimulating drinks, and high-seasoned food.

Diagnosis.—The diagnosis of hypertrophy of this gland is to be determined by the age of the patient, and by a careful physical exploration of the parts, rather than by a study of the rational symptoms, which are often simulated, to a painful extent, by some of the diseases of the adjacent and associated organs. The affections with which it is most liable to be confounded are stricture of the urethra, urinary calculi, catarrh of the bladder, and stricture of the rectum.

Hypertrophy of the prostate is a disease almost peculiar to advanced life; and hence, when an individual who has attained the age of fifty, fifty-five, or sixty, is affected with the train of symptoms above enumerated, the presumption is strong that the case is one of chronic enlargement of this body, and nothing else. Stricture of the urethra occurs most frequently in middle life, and its existence may always be readily ascertained by a careful examination of the canal in which it is located. When the two affections are combined—a circumstance, however, which is not very common—all that is necessary, in addition to the passage of the bougie, is to in-

roduce the finger into the rectum, which will at once decide the diagnosis.

The symptoms which accompany stone of the bladder are very similar to those of hypertrophy of the prostate, and hence a careless observer might easily mistake the one of these affections for the other. A little attention, however, will always enable him to make a correct diagnosis. If a stone be suspected, the introduction of the sound will not be slow in detecting its presence. Moreover, calculous disease occurs at all periods of life, while hypertrophy of the prostate, as was before stated, is most common in old age. In the former affection, one of the most important rational symptoms is a sudden stoppage of the urine from the falling of the concretion against the mouth of the urethra; in the latter, on the contrary, the water, when once started, usually flows until it is all discharged.

Catarrh of the bladder, the result of chronic or subacute inflammation of the lining membrane of this viscus, is induced by various causes, and is characterized by a copious discharge of thick, viscid, fetid mucus, a symptom which is also present in chronic enlargement of the prostate. The only way to distinguish between the two affections is by passing a bougie and by exploring the rectum with the finger.

Chronic enlargement of the prostate, especially when it exists in a high degree, is occasionally attended with difficulty of defecation, and a flattened appearance of the feces. Similar phenomena are generally present in contraction of the rectum from organic disease of its tunica, whether it be of a simple or malignant character; and the diagnosis is further obscured if, as often happens, the disease extend from the bowel to the bladder and the prostate, giving rise to a frequent desire to pass the urine, and an abundant discharge of thick, ropy, and offensive mucus. In such a case, a careful digital examination of the gut is indispensable to a correct appreciation of the situation and character of the lesion.

After all, it was hardly necessary to say even this much in regard to the diagnosis of this disease, for no educated surgeon would ever think of treating a case involving the slightest doubt, without a thorough exploration of the anus, the urethra, and the neck of the bladder.

To examine the parts through the rectum, the best plan is to place the patient upon his back, with his nates close to the edge of the bed, and the thighs widely separated from each other and raised towards the abdomen. Or, instead of this, he may support himself

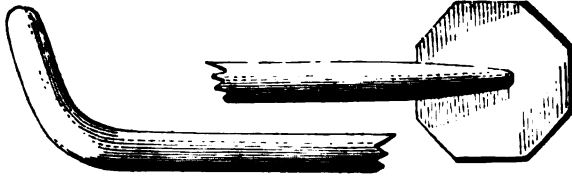
upon his knees and elbows, as is occasionally done in the operation for anal fistule. The surgeon then oils the right index-finger, and introduces it gently into the gut, previously emptied by an enema, as high up as possible, the palmar surface being directed forwards towards the pubic symphysis. Closing the hand, and pressing it firmly into the gutter between the nates, he moves the fore-finger about in different directions, first upwards along the median line, and then successively towards each side, noting, as he does so, the impression made upon it by the enlarged organ. If the finger be long, it can, by this procedure, be readily carried to a height of three inches, while its point may be made to describe the segment of a circle nearly two inches and a half in extent—a space rarely transcended by the prostate, however much it may be hypertrophied.

The extent to which the gland encroaches upon the rectum is variable; it may be very slight, or it may be so great as to produce partial occlusion of the tube, and consequently more or less difficulty in defecation. The tumor is usually easily felt by the finger, and rarely exceeds the volume of a pullet's egg; it may be as big, however, as a middle-sized orange, or even as a small fist. It is commonly larger on one side than on the other, and feels like a hard, solid substance, the surface of which is either smooth and uniform, or knobby and irregular. In the earlier stages of the disease, the gland may generally be pushed a little upwards and to either side; but when it is much enlarged, it is immovably fixed behind and below the arch of the pubes, and imparts to the finger which touches it the sensation of a hard, firm, and inelastic body. The lateral lobes are always more easily distinguished than the middle, which, when much augmented in volume, is frequently dragged up so high as to be entirely beyond the reach of even the longest finger.

Valuable information, in regard to the size and shape of the tumor, may generally be obtained by an exploration of the commencement of the urethra and the neck of the bladder, or, in other words, of the prostate itself. Indeed, if properly conducted, it throws more light upon the subject than any other mode of proceeding. The instrument employed for this purpose may be a common sound or a silver catheter, about eleven inches in length, and a little above the ordinary diameter, with a short, abrupt curve. One of the best contrivances of the kind, of which I have any knowledge, is that devised by Mercier, and delineated in his work on the genito-urinary organs. It consists simply of a straight metallic rod,

the vesical extremity of which, bent at an angle of from 100 to 110 degrees, does not exceed eight or ten lines in length. The

Fig. 151.



beak is rounded off, and slightly bulbous. The handle is furnished with a polygonal plate, which is arranged perpendicularly to the curved portion, and has a mark on the face corresponding with the beak. The rod is graduated, like an exploring bougie, and is a little larger than a common catheter. Thus constructed, the instrument is decidedly preferable to the ordinary one; it penetrates the parts more readily, and, owing to the brevity of its curve, is more easily turned about in the bladder; circumstances of great importance in such an investigation.

In conducting the exploration, the patient lies upon his back, as in ordinary catheterism, and the rectum is previously cleared by an enema. The bladder should contain a moderate quantity of urine, lest its contraction interfere with the success of the operation. The instrument, warmed and well oiled, is introduced in the usual manner until it reaches the neck of the bladder. Here, if there be any considerable enlargement, it will be almost sure to be arrested, and to convey to the finger the sensation as if it were pressing against a solid and resisting body. To surmount this obstacle, which may be either directly in the middle line, or towards either side, according as it is produced by the middle lobe, or by one or both of the lateral masses, it is generally necessary to insert the left index-finger into the rectum, and to use it to guide the instrument on into the bladder.

The conduct, if I may use the expression, of the instrument, as it passes along the neck of the bladder, will be influenced by the character and extent of the hypertrophy, and is deserving of particular attention. If the middle lobe alone is affected, the obstruction will be found at the middle line, and the handle will have to be considerably depressed to enable the beak to glide over it into the bladder. In addition to this it may be necessary, as above stated, to insert the finger into the rectum, in order to push the curved

portion of the instrument close against the pubic arch. To ascertain the size of the tumor, the vesical extremity of the explorator is hooked over its posterior surface, and passed successively round its sides, the finger being still in the bowel, and placed against the beak of the explorator. When both the lateral masses are enlarged equally at their inner margins, unaccompanied by hypertrophy of the rest of the organ, the passage will retain its normal course, and the instrument will advance in a straight line, just as it does in the healthy state of the parts. If, on the contrary, the growth be unequal, the canal will incline to one side, and the deformity will be indicated by a corresponding change in the direction of the explorator. Sometimes a double curve exists, one being formed, for instance, by the right lobe, and the other by the left; or, there may be two projections on one side with two corresponding depressions on the opposite.

Effects.—Hypertrophy of the prostate, especially when it exists in any considerable degree, is rarely unaccompanied by more or less suffering of the adjacent parts. The affections which thus complicate it are frequently of a most serious and distressing character, and call more loudly for medical and surgical interference than the primary malady upon which they depend.

The organ which is most liable to suffer in this disease is the bladder, which frequently becomes affected at an early period, in consequence of the mechanical obstruction afforded by the prostate to the flow of urine. The most common lesion is hypertrophy of the muscular tunic, varying in degree from the slightest change to ten, fifteen, or even twenty times the natural thickness. The muscular fibres are of a deep florid complexion; and, when the obstruction is of long standing, they are generally collected into large fasciculi, not unlike the fleshy columns of the heart. The laws, under the influence of which these alterations are effected, have been pointed out in a previous chapter, and need not, therefore, detain us here. Some of the very worst cases of hypertrophy of the urinary bladder that I have ever witnessed were produced by chronic enlargement of the prostate. The disease is generally accompanied with irritability of the organ, and diminution of its capacity; sometimes, however, it is insensible, and more or less dilated.

Another consequence of obstruction from enlargement of the prostate is a sacculated condition of the bladder. This is caused by an outward protrusion of the mucous membrane across the interstices of the hypertrophied fibres, and is a direct result of the

excessive contraction of these fibres upon the contents of the organ during micturition.

The mucous membrane is sometimes mammillated, or elevated into ridges, which are most conspicuous just behind the mouth of the urethra; at other times, it is ulcerated, of a dark, mottled color, engorged with blood, and studded with enlarged follicles. Fungous excrescences are sometimes found. The *bas-fond* is frequently entirely effaced, or converted into a narrow, deep *cul-de-sac*, forming a receptacle for the accumulation of mucus, the stagnation of urine, and the lodgement of calculous concretions. In the former case, the orifices of the ureters lie just behind the neck of the bladder, separated by a small interval, and directed obliquely inwards and forwards. This change is generally most prominent when the hypertrophy exists with the bar-like ridge of the bladder, described in a previous part of this treatise.

Enlargement of the prostate is not unfrequently followed by the formation of calculous concretions. The reason of this is that the earthy salts, naturally contained in the urine, are more apt to be retained in the *bas-fond* of the bladder, in consequence of the obstruction to micturition. When this event occurs, two circumstances, worthy of notice, are liable to take place; one is, that the stone is productive of less suffering from its inability to fall against the orifice of the urethra and thus impede the discharge of the urine; and the other, that it is more difficult, from its concealed situation behind the prostate, to extract it.

Hemorrhage is occasionally observed as an effect of this change in the volume of the prostate. The blood, which is usually small in quantity, may proceed from any portion of the bladder; but in general it is furnished by that part of the mucous membrane which covers the neck and *bas-fond* of the organ. Sometimes it proceeds from the gallinaginous crest, or even from the gland itself. It may be the effect either of exhalation, ulceration, or rupture. The blood is either discharged along with the urine, or it is retained and requires to be removed by artificial means.

The urethra, during the progress of this disease, often undergoes important alterations, which are liable to be followed by serious difficulty as it respects the evacuation of the urine and the introduction of the catheter and other instruments. These changes, which are deserving of attentive consideration, are limited exclusively to the posterior part of the canal, or that portion of it which is surrounded and embraced by the prostate, and are referable mainly to the dimensions, direction, and form of the tube.

Elongation of the prostatic portion of the urethra exists nearly always in the more aggravated forms of hypertrophy of this gland. It varies in degree from a few lines to two inches, which, however, it rarely attains. With this addition from disease, this portion of the canal may acquire a length of two inches, two inches and a half, and, in extraordinary cases, even three inches. Mr. Guthrie¹ mentions an instance in which the elongation was nearly four inches, requiring a proportionably long catheter to draw off the urine. With such an example, which is of course an extreme one, I have never met. The increase of length may be produced by hypertrophy of the lateral masses alone, by the middle lobe alone, or, as more commonly happens, by the joint agency of all these parts. In enlargement of the middle lobe, the urethra is dragged up behind the pubic arch, and is thus proportionably augmented in length, at the same time that it generally presents a sickle-like curve, the convexity of which looks towards the rectum. Hence, in drawing off the urine, the catheter should not only be unusually long, but unusually curved, and unusually depressed, otherwise it will fail to reach its destination.

When the lateral masses alone are affected, in an equal degree, the intervening canal may retain its natural size and cylindrical shape, or it may change its form, and become either diminished or increased in its dimensions. In a specimen in my cabinet, in which there is no appearance whatever of a middle lobe, but in which both the lateral portions are considerably augmented in volume, the prostatic part of the urethra is merely increased in length, while its form and size are apparently perfectly normal. From all absence of hypertrophy of the muscular coat of the bladder, it is evident that there was no obstruction during life to the evacuation of the urine. It is only, indeed, in cases where the increase of development takes place at the inner margins of the lateral lobes that the sides of the canal, embraced by them, will approach, and ultimately be brought into apposition with each other; a condition always accompanied by partial or complete retention.

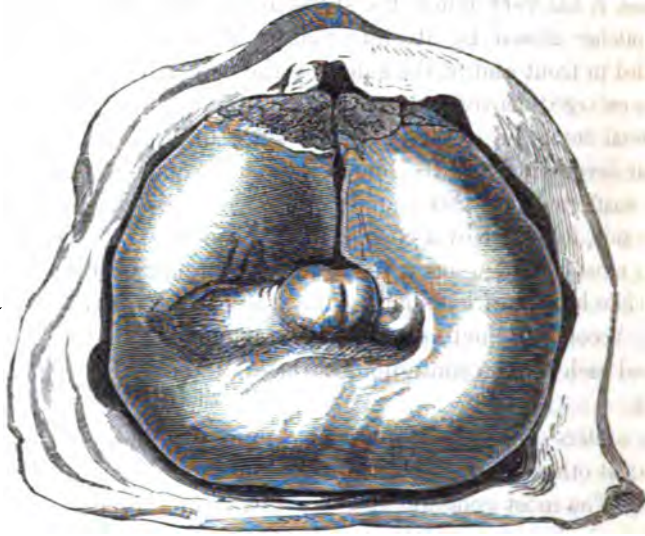
In hypertrophy of all the constituent parts of the prostate, the included portion of the urethra generally presents itself in the form of a vertical slit, which in some of my examinations I have found to be fully three-quarters of an inch in depth, that is, in the recto-pubic direction, while its sides were occasionally almost, if indeed

¹ *Op. cit.* p. 235.

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not quite, in contact with each other, as in Fig. 152, from a specimen in my collection. In such a case as this the obstruction must necessarily be attended with more or less impediment to the discharge of the urine, and hypertrophy of the muscular fibres of the bladder.

Fig. 162.



In a second series of cases of universal hypertrophy, the prostatic portion of the canal is materially increased in its diameter, evidently by the projection of the middle lobe between the two lateral, the edges of which are thus kept permanently asunder. This state, which occasionally exists to a great and deplorable extent, is often accompanied with incontinence of urine, which, under such circumstances, is liable to be ascribed to paralysis of the bladder.

Lateral curvature of the canal is occasionally met with, being generally dependent upon an unequal enlargement of the inner edges of the lateral lobes. An unusual projection on one side will necessarily encroach in a corresponding degree upon the other side, followed by a proportionate deviation from the median line. The curvature, which seldom exists in a high degree, is sometimes double; occasionally it is accompanied by a sort of contorted or twisted state of the urethra.

The form and dimensions of the vesico-urethral orifice, or mouth of the urethra, are considerably influenced by the nature of the by-

per trophy. When both lobes are equally and alone enlarged, it is generally circular, and but little, if any, diminished in size. Frequently it presents itself as a narrow, vertical slit, not unlike the chink of the glottis. This condition generally accompanies hypertrophy of the inner edges of the lateral lobes, and antero-posterior enlargement of the prostatic part of the urethra. In a third series of cases, it has very much the shape and appearance of the mouth of a pitcher closed by its lid; that is, it is a transverse fissure, bounded in front and at the sides by the lateral lobes, and behind by the enlarged central mass.

Lateral deviation of the urethra is sometimes produced by an irregular development of the middle lobe, the remainder of the gland being unaffected. In this manner one of the lateral masses is pushed to one side, followed by a corresponding bend in the tube, which is always most conspicuous at its posterior extremity. Finally, when the middle lobe is of unusual volume, the canal, as it extends backwards, becomes sometimes bifid, or separated into two grooves, bounded each by the contiguous surfaces of the middle and lateral masses.

The ureters are seldom entirely sound. Sometimes only one suffers; at other times, both are involved, though not in an equal degree. The most common lesion is dilatation of their caliber, with irregular thickening or attenuation of their tunics. Occasionally one of these tubes is partially obstructed, either as a consequence of contraction or a deposition of lymph.

The kidneys often sympathize in the disorganization of the prostate, or, rather, in the changes which it induces in the bladder and the ureters. One of the most common lesions is chronic inflammation of their parenchymatous tissues, which are of a dark complexion, engorged with blood, increased in size, and preternaturally firm in their consistence. In some instances, organs are partially destroyed, or converted into cysts, bags, or pouches. Ulceration of the mucous membrane is occasionally witnessed; now and then an abscess exists; and not unfrequently the parenchymatous tissues exhibit the peculiar degeneration known as Bright's disease.

The seminal vesicles are liable to suffer during the progress of this disease. The irritation is readily reflected from the prostate to these reservoirs along their excretory tubes, inducing in them, at first, subacute, and finally chronic inflammation, followed by structural lesion of their walls, alteration of their capacity, and modification

of their secretions, which are sometimes of a muco-purulent character.

The testicles, in hypertrophy of the prostate, are seldom much affected, unless it coexists with stricture of the urethra. Sometimes one of these organs is swollen, or both are morbidly sensitive, or there is an accumulation of water in the vaginal tunic; a complication of which I have seen several well-marked examples. The spermatic cords are generally natural.

It rarely happens that this disease exists in a marked degree, or for any length of time, without extending to and implicating the rectum. In consequence of the frequent and violent efforts which the patient is compelled to make to overcome the obstruction to the discharge of the urine, the hemorrhoidal vessels gradually become enlarged and varicose, and often give way under the pressure of their contents, leading thus to at least one variety of hemorrhoidal tumors. For the same reason prolapsion of the bowel is not uncommon. The lining membrane is habitually congested and irritated; an inordinate secretion of glairy mucus is going on; and every effort at defecation is attended with severe suffering. In fact, the bowel never feels comfortable or empty.

Treatment.—In entering upon the treatment of this affection, we have to lament the impotency of our art and the limited nature of our therapeutic resources. Notwithstanding the numerous attempts that have been made from time to time to place it upon a scientific basis, it must be confessed, however humiliating the acknowledgment may be, that it is eminently empirical, tentative, and unsatisfactory. These remarks are particularly true of the senile form of the complaint, which hardly ever yields to any mode of treatment, however judiciously devised or perseveringly employed. The disorder, in this respect, bears a close resemblance to certain kinds of morbid growths, which, when once developed, are utterly beyond the reach of medicine; no remedies exert the slightest influence upon their progress; nothing can change their character, modify their action, or suspend their nutrition. The malady progresses in spite of the best-directed efforts of the surgeon, and only ceases with life. For this result, so mortifying to his pride, and so unfortunate for the patient, the practitioner is not responsible; it is inherent in the very nature of the disease, and does not, therefore, depend upon any want of skill in the selection and application of our remedial agents.

General depletion is very rarely indicated in this variety of prostatic disease. If, however, the patient be plethoric, the enlargement

considerable, and the sympathetic reaction great, no remedy will be so likely to afford prompt and decided relief as a full bleeding at the arm. This is true, whatever may be the character of the hypertrophy. The propriety of a repetition of the venesection must depend upon the circumstances of each individual case, and often requires great judgment on the part of the practitioner. The detraction of blood should always, in the more aggravated varieties of the complaint, be speedily followed by the use of the antimonial and saline mixture, in the hope of subduing the action of the heart, unlocking the secretions, and clearing out the bowels. All irritating, heating, or griping cathartics must here, as in most of the other affections of the prostate, be entirely proscribed. Aloetic and other preparations having a particular tendency to the rectum, are to be avoided. At the same time, it must be borne in mind that an overloaded state of the bowels is never permissible; on the contrary, it is to be carefully guarded against, for it can never exist for any length of time without producing an increase of irritation, if not positive mischief. Sulphate of magnesia, or jalap and supertartrate of potassa, by rendering the feces soft and watery, are particularly well adapted to cases of such a nature. Where manifest disorder of the biliary secretion exists, a few grains of calomel will generally prove serviceable. Sometimes a laxative enema answers a good purpose, and obviates the necessity of giving this kind of medicine by the mouth.

The *food* should be perfectly plain, easily digestible, and unirritating. It should be well masticated, and be free from all stimulating admixtures. Condiments of every description, wine, brandy, and fermented drinks, are carefully avoided. Unless strict attention be paid to these rules, no reasonable hope, even of temporary amendment, can be indulged.

All the exciting causes of the disease are to be carefully avoided. Above all, it is necessary that the patient should abstain from horseback exercise and from sexual intercourse. From the tendency which these pursuits have to produce engorgement of the prostate and the rectum, I am satisfied that too much stress cannot be laid upon their prohibition. I would even go so far, in all cases, as to make the injunction absolute. Where the passions are unusually strong, and the desire for sexual intercourse is very frequent, and almost unconquerable, as it very often is in persons laboring under this complaint, it may even be necessary for a time to interdict female society, until, by proper treatment, the feeling in question is subdued.

Repose in the horizontal posture is hardly less necessary here than it is in the more acute affections of the prostate. By this remark, I do not, of course, mean that the patient shall confine himself constantly to his bed, and avoid all exercise—by no means; on the contrary, he should not neglect, whenever the weather is pleasant, to stir about for a few hours every day in the open air, either on foot, or in an easy carriage. When in the house, he may lie upon a lounge, or recline upon an easy chair with a movable back.

For the purpose of acting directly, as it were, upon the gland, and thereby lessening its volume, various remedies have been proposed. Among the more important of these are, iodine and its different combinations, cicuta, mercury, hydrochlorate of ammonia, local depletion, and counter-irritation by issues, setons, blisters, and tartar-emetic pustulation. Of these remedies, it may be observed, in general terms, that their efficacy has been fully tested by different observers, and that they are all to be regarded in the light merely of palliatives.

Iodine is indicated more especially in those cases in which the hypertrophy depends upon a syphilitic taint of the system, or an effusion of lymph, and which are characterized by a rapid progress. The best form of exhibition is Lugol's solution, or the iodide of potassium, either alone or in union with iodide of iron. The latter combination is particularly indicated where it is desirable to obtain both an alterative and a tonic effect. In whatever form it be administered, a long continuance of the article is imperatively demanded; care being taken to intermit its use for a few days every two or three weeks, as its good effects will be more likely to be elicited in this way than if it be employed persistently.

Cicuta has been with many a favorite remedy in the treatment of this affection; but it would be difficult to determine whether it really possesses any virtues in lessening the volume of the enlarged gland. The probability is that the attention of practitioners was first directed to its employment in hypertrophy of this body, from the beneficial effects which have occasionally been witnessed from its exhibition in cases of bronchocele. My own experience in its use in this affection is very limited; but judging from this and the little reliance which is placed in it by some recent writers, I should feel inclined to doubt its efficacy, especially when given by itself. Administered in combination with other articles, it may occasionally prove beneficial.

I have not found that *mercury*, exhibited with a view to its constitutional effects, is capable of exciting any particular influence over this affection in any of its forms or stages, nor are the accounts of this remedy published by others of a more flattering or encouraging nature. While mercury possesses an astonishing power in removing chronic enlargement of the liver, spleen, and testicle, it has little, if any, virtue in hypertrophy of the prostate and thyroid gland. Nevertheless, in obstinate cases, where other means have failed to afford relief, I should not hesitate to resort to it. In employing it, great care is to be taken not to produce ptyalism, which cannot do any good, and may do much harm. A moderate mercurial influence, sustained for four or five weeks, will be likely to secure all the advantages that this remedy is capable of affording. From three to five grains of blue mass with one grain of extract of cicuta, should be given three times daily, until the gums are slightly touched. The medicine is then to be discontinued until the primary impression begins to subside, when it may be again resumed and exhibited as before. Administered in this manner, proper attention being at the same time paid to the bowels, the diet, and exercise, a partial reduction of the affected organ may occasionally take place. When an alterant plan of treatment is required, as, for example, when the enlargement has been induced by a syphilitic cause, the mercury may be advantageously exhibited in union with iodide of potassium. Under such circumstances, the bichloride, cyanuret, or deuto-ioduret of mercury is preferable to calomel and blue mass. Donovan's solution would also be worthy of trial.

Hydrochlorate of Ammonia has been long familiar to the profession as a valuable remedy for the removal of visceral induration and enlargement. I am not aware that it has ever been employed in the treatment of hypertrophy of the prostate, and I merely call attention to the article here as well worthy of trial in this obstinate and intractable disease. It might be exhibited either alone or in combination with a minute portion of tartrate of antimony, in the dose of ten, fifteen, or twenty grains several times a day.

There are few remedies which afford greater relief in this affection, whether the result of inflammatory action or of senile decay, than *leeching*. The blood may be taken either from the anterior wall of the rectum, and consequently almost directly from the prostate itself, or from the perineum and the inside of the thighs. The quantity abstracted must be regulated by the circumstances of each individual case; but, in general, it is best that it should be small, and

that the operation should be frequently repeated. When the leeches are applied to the interior of the rectum, Amussat's anal speculum should be used. The plan which I usually adopt is to apply from four to six leeches to the perineum every fourth or fifth day. Sometimes blood may be advantageously taken by means of cups from the hypogastric region; but, in general, this is a more painful and less elegant mode than leeching.

Counter-irritation by issues, setons, blisters, and pustulation with tartar-emetic ointment is a valuable adjuvant in the treatment of chronic enlargement of the prostate, and should always be employed concurrently with other means. The choice of the remedy and the place to which it is applied must be regulated by circumstances. My favorite practice is to insert a seton into the perineum. In some instances, however, I have derived marked benefit from a caustic issue just above the pubes. Blistering and pustulation I rarely use. John Hunter recommends that vesicants should be repeatedly applied to the perineum, and that a constant discharge should be maintained from their surface by irritating unguents.

About fourteen years ago, Mr. Stafford,¹ of London, published an account of six cases of chronic enlargement of the prostate, most of them occurring in elderly persons, in which marked success followed the use of *iodide of potassium* exhibited by the rectum. The form in which it was given was that of a suppository, consisting of from three to five grains of the salt with five grains of the extract of *cicuta* and the same quantity of extract of *hyoscyamus*, introduced into the bowel night and morning. The strength of the remedies was gradually increased to ten grains. The treatment was continued from one to two or three months, and was aided by the daily use of a bougie anointed with iodine ointment, composed of five grains of the salt and one drachm of simple cerate. The urine was drawn off every twelve hours with the catheter. Under this management the gland became gradually reduced in size, the pain subsided, the irritation at the neck of the bladder disappeared, and micturition was performed nearly with its accustomed facility. These cases unfortunately prove too much; though it is but justice to Mr. Stafford to state that his mode of treatment has occasionally succeeded in the hands of other practitioners.

Sir Everard Home was in the habit of using suppositories of opium and hemlock, which not only, as he informs us, relieved the

¹ London Medical Gazette, Oct. 29, 1841, p. 181.

irritation, but also lessened the volume of the gland. Mercier states that he has derived great benefit from suppositories of Vigo's compound mercurial plaster.

To allay the irritation of the bladder which so frequently attends this disease, the warm bath, fomentations, opiate suppositories, and anodyne injections are necessary. The circumstances regulating the use of these remedies have been already pointed out, and need therefore not be dwelt upon in this place.

Finally, the patient must pay particular attention to the time and manner in which he voids his urine. He should be taught, on the one hand, the importance of not evacuating the bladder too frequently, and, on the other, of not permitting too great an accumulation. Micturition should not, on an average, be performed oftener than once every four hours. If the bladder be emptied every few hours, the mischief is much increased, and the organ is at length rendered so irritable and fretful as to be unable to contain more than a few ounces of water at a time. Moreover, he must not strain in passing his urine, but endeavor to do this in as calm and composed a manner as possible. The object should be to maintain the prostate and bladder constantly in a quiescent condition; and hence it is frequently necessary to draw off the water at stated periods with the catheter. Any considerable accumulation is likely to prove a source of irritation, if not of actual disease, to the affected parts. For the same reason, injection of the bladder, as advised under the head of "catarrh" of that organ, often produces great relief by dislodging the thick, ropy, and offensive mucus which so often collects in the *bas-fond* of the bladder.

To relieve the prostate from the pressure of irritating urine, and deprive the urethra temporarily of its office, it has been proposed to puncture the bladder above the pubes, and make the patient wear a silver tube. An opportunity is thus afforded to the water to drain off nearly as fast as it is deposited in the bladder, which is thereby placed in an easy, quiet condition, and prevented from constantly contracting upon its contents. As a *dernier resort*, such an operation may perhaps be justifiable, on the ground that it may prolong life; but under no other circumstances, I conceive, should it ever be performed. Independently of the inconvenience and discomfort to which it must necessarily subject the patient, rendering him disagreeable to himself and to all around him, it is by no means free from the danger of urinary infiltration; nor is it at all certain that it will, in any case, effect a cure.

As means calculated to produce a direct impression upon this organ, mention may be made here of cauterization, excision, incision, and crushing.

It is not easy to comprehend how *cauterization* acts in bringing about a diminution of the volume of a hypertrophied prostate, and yet the operation has not only been proposed but received high encomiums. If the application could be made directly to the affected structures, it would be easy to perceive that it might prove beneficial, but this is not so apparent when it is remembered that it can only be made to the mucous membrane of the urethra, which, in the situation under consideration, is of very limited extent. Moreover, the operation is frequently productive of severe pain and of an aggravation of all the symptoms, both local and constitutional. It is for these reasons that I have always had a disinclination, almost amounting to aversion, to employ it, except in the very mildest forms of the disease. The cauterization, if deemed advisable, is performed with Lallemand's instrument, which is carried into the prostatic portion of the urethra, with the lining membrane of which it is gently but fully brought in contact. It should not be oftener repeated than once every night, ten, or twelve days, and any irritation following it should be combated by demulcent drinks, anodynes, recumbency, and the warm bath.

An attempt has been recently made to treat hypertrophy of the prostate, especially of its middle lobe, by the direct application of different *ointments*, as those of iodine and iodide of potassium. The proposal originated with Mr. Stafford,¹ who has long been favorably known for his skill in devising means for overcoming some of the mechanical obstructions of the urinary organs. His plan consists in charging the point of a bougie with the substance intended to be used, and then dipping it into melted tallow so as to give it a thin coating. The instrument, thus prepared, is passed down to the affected part, where the tallow is soon removed by the heat of the mucous membrane, followed by the escape and diffusion of the ointment. By drawing it gently backwards and forwards, a certain amount of friction is produced, greatly facilitating the inunction. Much caution is required in regard to the strength of the ointment, on account of the prostate being frequently in an irritable and inflamed condition, and consequently unable to bear any strong application. The parts must occasionally even be soothed by a sort of

¹ An Essay on the Treatment of some Affections of the Prostate Gland, p. 19. London, 1840.

preliminary treatment with anodynes, such as belladonna, opium, or hyoscyamus. The safest plan, therefore, always is to begin with a very weak ointment, as one, for example, composed of one grain of iodide of potassium to the drachm of simple cerate, and gradually increase its strength as the patient is found able to bear it. "I have then gone on," says Mr. Stafford, "with two, three, four, five, and even as far as ten grains, or a scruple to the drachm, according as the case required it. After this I have added iodine to it; half a grain, one, two, three, four, or even more grains in the same manner. The surgeon who applies it can alone judge of its effects."

When the potash cannot be applied directly to the gland, in the manner above indicated, it may be administered by the rectum in the form of injection. From thirty to forty grains of this article, dissolved in a suitable quantity of rain water, may be thus introduced twice a day, at the same time that other remedies, such as those already pointed out, are employed to aid its action.

Scarification of the affected gland has occasionally been practised, and sometimes apparently with advantage. The operation was first suggested by Mr. Costello,¹ of London, in 1837. From the good effects which this operation frequently exerts in chronic enlargement of the tonsils, the uvula, and the testicle, it is not surprising that it should have been applied to the treatment of hypertrophy of the prostate. It not only diminishes the vascular turgidity, which is generally so prominent a pathological condition in this lesion, but it has a tendency to stimulate the absorbent vessels, and thus to bring about a reduction of the volume of the diseased organ. The quantity of blood procured in this way sometimes amounts to several ounces. The operation, which gives rise to little or no pain, is performed with a curved lancetted stylet, similar to that used for dividing strictures of the urethra, and is quite safe in the hands of an experienced surgeon, one well acquainted with the anatomy of the parts. It may be repeated every third or fourth day, and is particularly worthy of trial where there is an unusual degree of irritability of the prostate.

Excision of the prostate has been recommended. The operation is spoken of by some of the older surgeons, but has not, so far as I know, received the sanction of any of the moderns. It does not appear that any one has really ever had the hardihood or folly to perform it, and this is no doubt the best thing that can be said in

¹ British Annals of Medicine for February and March, 1837.

commendation of it. The idea of extirpating the entire gland is, indeed, too absurd to be seriously entertained. Such an operation, even supposing it were practicable, and that the patient could survive it, would be far worse than the disease; for it would inevitably lead to the formation of an incurable fistule, thereby rendering life utterly miserable. Excision of the middle lobe would be less objectionable, and might, in fact, be resorted to with a fair prospect of success, in all cases in which this body forms a permanent obstacle to the passage of the urine. When it is attached by a narrow foot-stalk, the operation could hardly fail, and might afford the only chance of relief. I should certainly myself prefer it, in such an event, to the operation of "crushing," recommended by some of the French surgeons, and to the puncture of the bladder above the pubes. I should not even expect much difficulty in the execution of it. The position of the patient and the incisions in the perineum would have to be the same as in the lateral operation of lithotomy. The enlarged lobe might be easily cut off at its base with a pair of stout, probe-pointed scissors, curved on the flat; or, it might be twisted off with a polypus forceps.

Another operation for the relief of chronic enlargement of the prostate is *incision*. One of the principal advocates of this method of treatment is Mr. Guthrie,¹ of London. It is founded upon the fact that the operation of lithotomy, performed upon persons affected with this complaint, has occasionally relieved them of it. Of

¹ *Op. cit.* p. 251. "A question has arisen in my mind," says Mr. Guthrie, "whether any operation could be done on the prostate from the perineum; and I was led to entertain it from finding that in a patient, on whom I had operated for stone, whose prostate gland was much enlarged, I had rendered him a further service in the diminution of the prostate; so that instead of making his water with difficulty, he afterwards made it easily, and the catheter passed with facility, instead of meeting with a considerable obstacle at the neck of the bladder. In fact, I was satisfied I had cured, or nearly so, the disease of the left lobe of the prostate, which I found to be much enlarged during the operation." In commenting upon this operation, the late Dr. Parrish,* of Philadelphia, adduces the case of Chief Justice Marshall, from whom a large number of urinary calculi were removed by Dr. Physick. The prostate was considerably enlarged at the time of the operation, and the third lobe was distinctly felt in the bladder. The illustrious patient happily recovered, and enjoyed tolerable health for several years. He finally died of disease unconnected with the urinary organs. A post-mortem examination being made, it was ascertained that the volume of the gland had not been diminished by the operation. Mercier has advanced the same opinion as Mr. Guthrie.

* Practical Observations on Strangulated Hernia, and some of the Diseases of the Urinary Organs, p. 256. Phila., 1836.

the propriety and utility of this process I am unable to speak from personal observation, but, judging from the results recorded by others, I am disposed to place little confidence in it. If it is calculated to do any good at all, it must be in those cases of hypertrophy of the gland in which there is extraordinary vascularity of the parenchymatous substance, and a varicose condition of the venous plexus. Where the disease is complicated with urinary calculus, no one, of course, would hesitate to have recourse to the knife. The operation is conducted upon the same principles as the operation of lithotomy; the lateral or bilateral method being adopted according as one or both lobes are affected.

The operation of *crushing*, devised, I believe, by some French surgeon, is applicable only to the middle lobe of the prostate. It was evidently originally suggested by the operation of lithotripsy, of which, in fact, it is merely a modification. It consists in seizing hold of the enlarged body with Jacobson's lithotrite, and grinding, squeezing, pressing, or mashing it into a soft, pulpy substance, which is detached partly by the instrument, and partly by the sloughing process, and afterwards discharged with the urine. The instrument is used at first as a sound, to ascertain the site of the tumor, which is then caught between its branches, crushed, and broken off. The proceeding is best adapted to those cases in which the middle lobe adheres by a small pedicle, and rises up behind the mouth of the bladder in the form of a narrow, elongated valve. The operation is not attended with much pain, for the affected part is usually very tolerant, but it is liable to be followed by hemorrhage, severe inflammation, and even death, on which account it ought, I think, to be proscribed. Besides, its performance involves an amount of skill which few surgeons possess.

Perforation of the middle lobe of the prostate has been proposed where this body forms an insuperable barrier to the evacuation of the urine, whether by the natural efforts or by artificial means. The expedient, under such circumstances, is decidedly preferable, I conceive, to puncture of the bladder; an operation which I have never had occasion to perform on account of enlargement of the prostate, and which I hope, for the honor of modern surgery, will soon be wholly abandoned. I have a specimen in my private collection in which this method was adopted with admirable effect. The case occurred during my residence at Cincinnati, in a German laborer named Langhoff, sixty-seven years of age, who had been afflicted for a long time with difficulty in voiding his urine, in consequence

of hypertrophy of the middle lobe of the prostate, which no plan of treatment that could be devised had the least tendency to diminish. At length, complete retention, irremediable by the ordinary means, occurred, when the operation in question was agreed upon, and at once performed with a silver, conical-pointed catheter. Immediate relief followed, and the patient lived in comparative comfort for several years after. He ultimately died of acute pneumonitis. I found the prostate enlarged in all directions; the middle lobe formed a broad mammillated tumor, pierced at its base by a rounded canal fully equal in diameter to the membranous portion of the urethra; and the bladder was universally hypertrophied and greatly reduced in size.

When this operation is deemed expedient, it may be performed either with a silver catheter, rather conical at the point, or with a small trocar inclosed in a silver canula. The instrument which I would recommend does not differ materially from that devised by Mr. Stafford, of London. It consists simply of a silver tube, curved lik a common catheter, and containing a movable trocar, which may be retracted or thrust forward at pleasure. The instrument is introduced in the usual manner as far as the seat of the obstruction, where it is firmly held until the trocar is pushed across the base of the swelling into the bladder. The want of resistance will indicate that the transfixion has been completed. The trocar is then withdrawn, and the canula left in the bladder. In a few days this is also removed, and a large catheter substituted. In this manner the treatment is conducted until the new canal has become lined by a mucous membrane, when the occasional passage of the catheter will suffice to prevent occlusion. In performing this operation, great care must be taken to keep the instrument in the middle line, and at a proper distance, on the one hand, from the arch of the pubes, and, on the other, from the rectum. It need hardly be added that a thorough knowledge of the anatomy of the parts and great delicacy of touch are indispensable prerequisites to its successful execution.

CHAPTER IV.

ATROPHY OF THE PROSTATE.

THE prostate, like other organs, is liable to atrophy. The affection sometimes exists as an effect of senile decay, but more frequently it is the result of mechanical compression, or structural disease. Thus, a calculous concretion, either developed in the gland itself, or habitually lying at the neck of the bladder, may, by the pressure which it exerts upon the prostate, lead to gradual absorption of its substance, and great diminution of its volume. A similar change is sometimes brought about by an abscess, or a tubercular deposit. In fact, most cases of atrophy of the prostate are produced in this manner. The senile form of the lesion is extremely rare, and seldom exists as a pure, uncomplicated affection. The few instances of it which have fallen under my observation occurred in old persons who had long suffered under disease of the bladder, or of the bladder and the urethra..

Atrophy of the prostate occasionally exists as a congenital defect. Baillie¹ has described a case in which the gland was so extremely small that it could hardly be considered as being fit for its office. It is proper to observe, however, that the deficiency in this instance was associated with ectropium of the urinary bladder, and malformation of the genital organs: the prostatic utricle was larger than natural.

The extent of the atrophy varies; thus it may involve the entire gland, one of its lobes, or only a part of a lobe. In extreme cases the proper structure is almost entirely effaced, and hardly anything remains but its fibrous capsule. In the more ordinary forms, however, the gland is only somewhat reduced in bulk, preternaturally firm, and of a paler color than in the normal state. The cellular element is wanting, being superseded by the fibrous.

¹ London Medical and Chirurgical Trans., vol. i. p. 194.

CHAPTER V.

HETEROLOGOUS FORMATIONS OF THE PROSTATE.

SECTION I.

SCIRRHUS.

THE occurrence of scirrhus in the prostate is extremely rare. It is hardly ever met with before the age of fifty-five or sixty, and is most common in persons who have long labored under stricture of the urethra, urinary calculi, or organic disease of the bladder. Formerly every species of induration of this body was regarded as carcinomatous, and it is highly probable that many, even at the present day, notwithstanding the recent advances of pathological anatomy, still confound these lesions with each other. I have myself never observed a well-marked example of pure, uncomplicated scirrhus of the prostate. Professor Walshe¹ states that true scirrhus is of singularly rare occurrence in this body, and he does not seem to have met with it in his own dissections. Dr. Mercier,² of Paris, expresses himself to the same effect. "Nothing," says he, "is more rare than a scirrhus degeneration of this gland;" and he adds that, notwithstanding his long and laborious researches, he has never seen a case of cancer primitively developed in this organ. On the other hand, Chopart, Desault, Sæmmering, Boyer, Howship, and others speak of it as being extremely common.

Too little is known of this affection to enable us to trace its history, or to determine its causes, progress, and diagnosis. The gland is of a gristly hardness, knotty and irregular in its shape, and of a whitish, grayish, or drab color, with delicate fibrinous intersections. Its volume is usually somewhat augmented, but it may be quite natural, and occasionally it is even considerably diminished. The new deposit may occupy the whole gland, or it may be limited to a particular portion of it; in general, it involves both lobes, though

¹ On Cancer, by Warren, p. 308. Boston, 1844.

² Recherches sur les Maladies des Organes Urinaires et Genitaux, p. 167. Paris, 1841.

not in an equal degree. In other respects the disease follows the same course as in other parts of the body. Micturition is frequent and difficult; a sharp, lancinating pain is felt at the neck of the bladder, in the rectum, and along the inside of the thighs; the urine is high-colored, fetid, and surcharged with viscid mucus; the general health is impaired; the countenance exhibits a peculiarly cadaverous aspect; and the patient, harassed by suffering, and deprived of appetite and sleep, finally dies from hectic irritation. The duration of this affection varies from twelve months to two or three years.

Scirrhus of the prostate is no more amenable to treatment than scirrhus in other parts of the body. Rest in the recumbent posture, strict attention to the diet, the occasional application of a few leeches to the perineum, the warm hip-bath, and the exhibition of anodynes by the mouth and the rectum, comprise the whole of our therapeutic resources. If retention of urine is present, the catheter is used to prevent undue distension and rupture of the bladder.

SECTION II.

ENCEPHALOID.

Encephaloid, medullary sarcoma, or fungus hæmatodes sometimes occurs in the prostate. Although more frequent than scirrhus, or hard cancer, it is, nevertheless, exceedingly rare, and hence a good history of it is still a desideratum. The records of a few isolated cases constitute all our available information.

The disease is most common in advanced life, though no period seems to be exempt from it. In nearly all the cases, the history of which I have had an opportunity of examining, it occurred after the age of fifty. In one instance, recorded below, the patient was seventy years old. On the other hand, in a case reported to me by Professor Bush, of Lexington, the age was only three years.

The origin of this affection is sometimes attributed to the irritation of a urinary calculus, to the presence of a stricture, or to the effects of protracted inflammation of the urethra; but, in general, it commences here, as in other parts of the body, without any apparent cause.

A sense of weight or uneasiness at the neck of the bladder, with a slight impediment to the flow of urine, is usually the first sign of this disease. This is soon succeeded by a discharge of blood, which

is at first so small as hardly to tinge the urine, but gradually increases in quantity, and at length becomes a source of great debility, if not actual exhaustion. In some instances it is voided in large clots, and constitutes the major part of the excretion. There is ordinarily but little pain until ulceration sets in, when it is frequently exceedingly severe, as well as persistent. Sometimes it is dull, heavy, and aching; sometimes sharp and lancinating, as in scirrhus; sometimes burning, scalding, or pulsatile. In all cases there is a constant desire to pass urine, and sympathetic irritation of the rectum with an inclination to relieve the bowels. As the malady progresses, the urine becomes turbid, fetid, ammoniacal, and loaded with thick, ropy mucus; the countenance exhibits a peculiar cadaverous aspect; hectic irritation arises; and, finally, death, so long and so anxiously expected, closes the scene. The duration of the disease seldom exceeds twelve months.

There are no signs by which encephaloid can be distinguished, with any clearness, from some of the other affections to which this body is liable. The most reliable evidences are, a discharge of blood with the urine, the occasional expulsion of cerebriform substance or organized clots, the frequent desire to pass water, and the ability to feel the enlarged gland through the rectum. The heterologous deposit may affect the entire organ, or be limited to one of its lobes, which, however, is exceedingly rare. The resulting tumor varies in its volume from that of a pullet's egg to that of a middle-sized orange.

A dissection of the tumor shows it to be composed of all the elements of the encephaloid tissue, as it occurs in other organs of the body. In one part it exhibits a fibrous arrangement, in another, perhaps, a structure similar to that of the cerebral substance, and in a third the appearance of an apoplectic depôt. Sometimes the proper glandular texture is completely annihilated, while at other times portions of it remain, either perfectly distinct, or, as more frequently happens, intermixed with the morbid growth. The commencement of the urethra, the neck and bas-fond of the bladder, the ureters, and even the kidneys are often involved in the mischief.

No kind of treatment, either local or general, is of any service in this affection, which is entirely beyond the influence of remedies, even in its earliest stages. All that can be done is to draw off the urine, as occasion may require, with the catheter, to allay pain by anodynes and opiate suppositories, and to support the strength by nourishing diet, stimulants, and tonics.

The subjoined cases are well-marked examples of encephaloid in early life and old age:—

CASE I.—A child, aged three years, the history of whose case has been kindly communicated to me by Professor Bush, after having been affected with vesical disease for about six months, was seized with retention of urine. With very great difficulty a catheter reached the bladder, and effected its evacuation. The operation was afterwards twice repeated at intervals of two days. Soon after this period the obstruction became so obstinate as to render it utterly impossible to pass the instrument, the further use of which was accordingly abandoned. Next, as the urgent alternative, the bladder was punctured above the pubes, and a silver canula introduced. On the third day after the operation there was a fair discharge of water by the natural channel; but it soon ceased, and resumed its former route through the canula, which was retained for three weeks. The constitutional disturbance gradually increased in severity, and the child ultimately died perfectly exhausted. On the dissection, the prostate gland was found to be enlarged to the size of a hen's egg, and completely transformed into medullary matter.

CASE II.—A boy, five years of age, whose case is described by Mr. Stafford,¹ had suffered for several months under irritable bladder, and was at length seized with retention of urine. The countenance was anxious and distressed, there was considerable fever, and the tongue was furred. A small gum-elastic catheter was passed without difficulty, and twenty-five ounces of urine of natural color drawn off. As the bladder had completely lost its power, the instrument was used at first twice a day, and afterwards it was retained continually. There was no pain or any other symptom denotive of disease of any particular organ. The boy gradually sank, and died in eight days from the time Mr. Stafford first saw him. The prostate was found to be somewhat globular in its shape, and equal in size to the largest walnut. Immediately behind the orifice of the urethra the middle lobe projected upwards in the form of a rounded nipple-like process, nearly of the volume of a small hazel-nut. A section of the gland exhibited a decidedly encephaloid character, both in color, consistence, and texture, apparently intermixed at one part with melanotic matter. The bladder was contracted to the size of a turkey's egg; it contained about an ounce of urine mingled with purulent matter, and its mucous membrane was somewhat thickened. The kidneys, brain, and viscera of the chest and abdomen were healthy.

CASE III.—In a patient, aged 68, Mr. Langstaff² found an encephaloid tumor of the prostate as large as an orange; it was connected chiefly with its third lobe, and had occasioned absorption of the mucous membrane of the bladder, into the cavity of which it projected so as to plug up the orifices of both ureters and also nearly that of the urethra. The patient had suffered under vesical symptoms for upwards of five years; and for the last six months, he had had most excruciating pains in the whole urinary apparatus. He voided his urine in drops, or in a very small stream, had constant uneasiness in the rectum, and was costive. One of the smallest sized bougies passed with great difficulty. The existence of the tumor was ascertained by examination with the finger in the rectum. Towards the last there was continual hæmaturia, and death was finally caused by the rupture of the right ureter, followed by an effusion of three pints of urine and blood behind the peritoneum. Encephaloid tumors were also contained in the liver and lung.

¹ London Medico-Chir. Trans., xxii. 218.

² Walshe on Cancer, p. 309. Boston, 1844.

CASE IV.—Mons. Mercier¹ describes an encephaloid prostate in an old man of seventy. He was excessively emaciated, and had experienced difficulty of micturition for eighteen months. He had never had any disease of the urinary organs. Death occurred on the thirtieth day after his admission into the Hôtel-Dieu. The prostate was found to be of the volume of an ostrich's egg, and exhibited, in the highest degree, all the characters of softened encephaloid tissue. Each lobe contained a sanguineous deposit, similar to what is seen in the brain in apoplexy, of a black color, and feeble consistence. The posterior part of the urethra was destroyed, or converted into a soft, pulpy substance. The bladder was moderately distended with black urine, its walls were thickened, and its mucous membrane was of a slate color, and elevated, at two points, by little abscesses. The small curvature of the stomach also contained softened encephaloid matter. A few tubercles existed in the lungs.

CASE V.—A man, fifty-five years of age, naturally of a robust constitution, but worn out by long suffering, came under the care of Mons. Civiale² in 1837. He had labored for the last thirty years under symptoms of gravel; his urine, which was frequently bloody, was generally turbid and fetid, and deposited a large quantity of mucus; the kidneys had been long deranged; and micturition was difficult and painful. During the last five months his condition had been so much aggravated that he was obliged almost constantly to keep his bed. He had been repeatedly sounded, but no foreign body was detected until he came under the care of Mons. Civiale. He grew gradually worse, and death soon relieved him of his sufferings. The bladder contained a mulberry calculus of the size of a pigeon's egg. The middle lobe of the prostate was as big as a pullet's egg, and formed a considerable projection at the anterior angle of the vesical trigone. In front, the tumor extended to the membranous portion of the urethra, and presented a large excavation, which was prolonged backwards from one and a half to two inches. The prostate at this point was disorganized and softened, yielding, upon pressure, a cerebriform substance.

CASE 6.—A man, aged seventy-five, was admitted, December 3, 1852, into King's College Hospital, London, under the care of Professor Fergusson, having suffered for the last four years under enlargement of the prostate gland. He was in a sinking condition at the time, and was obliged to have his urine drawn off night and morning. An examination of the affected parts through the rectum gave excessive pain, and detected a tumor as big as an orange. A large quantity of bloody urine was drawn off with the catheter. The man sank three days after admission. The prostate gland was greatly enlarged, and a section of it exhibited all the characteristic features of medullary sarcoma. The coats of the bladder were enormously thickened, the right ureter and renal pelvis dilated, and both kidneys affected with carcinomatous disease.³

¹ *Recherches sur les Maladies des Organes Urinaires et Genitaux*, p. 169.

² *Traité Pratique sur les Maladies des Organes Genito-Urinaires*, Deuxième partie, p. 446.

³ *London Lancet*, vol. ii. p. 151, 1853.

SECTION III.

COLLOID AND MELANOSIS.

Of these two affections I have never met with any examples in the prostate, nor am I aware that any instances of it have been recorded in our scientific treatises and medical journals. The nearest approach to melanosis of this organ of which I have any knowledge, occurred in the case mentioned by Mr. Stafford, previously referred to, in which a peculiar black substance was interspersed through an encephaloid tumor in a boy five years of age.

SECTION IV.

TUBERCLES.

The prostate gland is occasionally the seat of tubercles. The affection, however, is extremely rare, and is usually associated with similar deposits in the seminal vesicles, urinary bladder, kidneys, testicles, and other organs. In a case which came under my observation in 1838, during my residence in Cincinnati, it coexisted with psoas abscess. The patient was a tall, slender man, twenty-seven years of age, for the last four of which he had labored under spinal disease, from the immediate effects of which he finally died. The tubercles, which were eight in number, and about the size of a pea, were of a pale yellowish color, of a soft, curdy consistence, and scattered through different parts of the gland, which was at the same time considerably reduced in bulk. Strumous matter was also contained, and that in great abundance, in the seminal vesicles, in the right kidney and ureter, and in the lymphatic ganglions of the pelvis. The lungs were entirely free from it.

The deposit occurs either in one tolerably large mass, or in the form of miliary bodies, from the size of a pin's head to that of a small pea. Occasionally the whole organ is transformed by the heterologous substance. I am not aware that the deposit ever exists here, as it does in some of the other structures, as an infiltration. The probability is that the component elements of the gland are too compactly arranged to admit of such an occurrence. The morbid product, whatever may be the form in which it appears, is of a pale yellowish, grayish, or whitish aspect, and of a soft, cheesy, or curdy

consistence. It manifests the same disposition to disintegration and the formation of abscesses as in other situations. Lallemand mentions an instance in which not less than thirty small abscesses of this kind were found in the prostate gland; they coexisted with numerous crude tubercles in the same organ and also in the kidneys.

The volume of the prostate in this affection may be natural, increased, or diminished. Most commonly it is in the latter condition. In the case previously referred to it was remarkably small. The deposit seldom occurs in early life, at least so far as we can judge from the few instances of it upon record, and it always manifests a preference for the mucous follicles, in which it seems to be originally developed.

Tubercles of the prostate gland produce no characteristic symptoms. In the case which fell under my observation at Cincinnati, the only evidence of disease of the urinary apparatus was an irritable condition of the bladder, accompanied with a rather frequent desire to make water. When ulceration or abscess occurs, the progress and termination are the same as in similar affections resulting from ordinary causes.

Since the diagnosis of this malady can never be satisfactorily determined, every attempt to treat it upon scientific principles must prove unavailing. When its character is suspected, recourse may be had to the internal exhibition of iodine in some of its more valuable forms, and to counter-irritation in the perineum by an issue or a seton.

CHAPTER VI.

CYSTIC DISEASE OF THE PROSTATE.

CYSTS occasionally exist in the prostate, but their occurrence is extremely rare, and is interesting rather in a pathological than a practical point of view. They vary very much, both in number and size, as well as in the character of their contents. In general, there are not more than six or eight, from the volume of a millet-seed to that of a currant, a pea, or a hazel-nut. In some instances, however, their number is much greater; and, on the other hand, examples occasionally occur in which there is only one, which is then

proportionably large, occupying, perhaps, one-fourth, one-third, or even one-half of the entire gland. Their contents are transparent, fluid, and of a serous character. Particular cells sometimes contain a thick, viscid, and albuminous substance, either perfectly clear, or of a white, opaline appearance. The prostate, in this affection, is usually hypertrophied, and consolidated in its texture. When the cysts are large and numerous, which, however, rarely happens, the proper structure is, in great measure, absorbed, or converted into a dense, fibrous substance.

The mode of origin of these cysts has not been determined. They are in all probability dilated and closed follicles, or expanded and closed excretory ducts, and are therefore similar to the encysted tumors, which occur upon the inner surface of the lips, round the mouth of the uterus, and in the interior of the kidneys, from obstruction of the uriniferous tubes. Nothing is known respecting the progress, symptoms, termination, and treatment of this affection. It has been observed at different periods of life, but old persons are most obnoxious to it.

CHAPTER VII.

FIBROUS TUMORS OF THE PROSTATE.

ROKITANSKY, in his *Pathological Anatomy*, states that he has frequently met with fibrous tumors of the prostate. In my own dissections I have several times seen the same affection, and a well-marked specimen of the kind is contained in the private collection of my friend Dr. Sabine, of New York, to whom I am indebted for several drawings illustrative of the morbid condition of this organ. Fibrous tumors of the prostate vary in their volume from that of a pea to that of a small almond; they are of a rounded, spherical, or ovoidal form, of a firm, dense consistence, and of a dull, grayish color. They are usually situated on the outer surface of the gland, but occasionally they project inwards, so as to encroach upon the urethra and the neck of the bladder. In the few cases in which I have observed these tumors, they were solitary; sometimes, however, there are as many as three or four. When they are seated upon the periphery of the organ, they give it a rough, knobby, or

nodulated appearance. They usually grow from a broad base, which seems to be insensibly lost in the proper glandular substance. A section of these tumors displays a grayish or drab-colored tissue, of a tough, inelastic character, having little moisture, and but few vessels.

Fibrous tumors of the prostate bear a strong resemblance, both in their situation and structure, to fibrous tumors of the uterus. They are always associated with hypertrophy of the gland, and are rarely found, except in old subjects, who have long labored under organic disease of the urinary apparatus. They are probably developed under the influence of chronic irritation, leading to irregular, local, or circumscribed supernutrition of the parenchymatous structure of the part. There are no symptoms which, so far as has been ascertained, are peculiar to this species of formation, and hence nothing is known respecting their treatment.

CHAPTER VIII.

HEMORRHAGE OF THE PROSTATE GLAND.

THE prostate gland, like other parts of the body, is liable to hemorrhage, varying in degree from a few drops to several ounces. The occurrence, however, is extremely rare, and is chiefly met with in aged subjects, in consequence of the forcible use of instruments, leading to a laceration of the substance of the organ, or to a rupture of some of its vessels, which, at this period of life, are frequently in a state of enlargement and varicosity. Catheterism, under such circumstances, even when performed with extreme delicacy and gentleness, is liable to be followed by a copious flow of blood. In old persons affected with hypertrophy of the gland, riding on horseback, venereal indulgence, a fall on the buttock, or a blow upon the perineum, will occasionally give rise to this form of hemorrhage, which, although generally slight, may be so abundant as to create no little uneasiness for the patient's safety. A smart bleeding of the prostate is sometimes produced by the irritation of a calculus, either of the bladder, or lodged in its own substance. The hemorrhage is occasionally spontaneous, and then probably depends upon

ulceration of the organ, a granular condition of its surface, or the presence of a fungous, erectile, or encephaloid tumor.

Hemorrhage of this organ is generally difficult of recognition, owing to its liability to be confounded with hemorrhage of the bladder and the urethra. When the blood proceeds from the prostate, a portion generally escapes in a pure state, free from urine, both before and after the evacuation of the bladder, while that which passes into the bladder is of a dark muddy appearance, and is voided during micturition. These phenomena, however, are not characteristic, and it is only by coupling with them the history of the case that they assume a diagnostic value. Thus, if along with an escape of blood from the urethra or bladder, the patient is conscious of having received an injury either by a blow on the perineum, or by the introduction of an instrument in the region of the prostate, the probability is that it proceeds from this gland, and not from the urinary passages, properly so termed. When the hemorrhage is caused by an ulcer of the prostate, or the presence of a hæmatoid tumor, the circumstance is, in general, easily determined by the sound or catheter.

The prognosis of this variety of hemorrhage is favorable or otherwise according as it is simple or traumatic, or dependent upon ulceration of the gland, or the presence of malignant disease. In the former case, it is generally readily amenable to treatment, and, therefore, free from danger; in the latter, it is commonly obstinate, and irremediable.

The treatment of hemorrhage of the prostate is to be conducted upon the same principles as that of hemorrhage of the urinary passages generally. In many cases, it ceases spontaneously, or readily yields to rest in the recumbent posture, cold applications to the perineum, and cold, acidulated drinks. Where these means fail, or where the hemorrhage is at all copious, recourse is to be had to the exhibition of gallic acid, in union with opium, every two or three hours, in the proportion of two or three grains of the former to half a grain of the latter. Few cases resist this combination beyond ten or twelve hours, and in many instances it arrests the discharge much sooner. When gallic acid fails to afford relief, acetate of lead, tannin, alum, sulphuric acid, spirits of turpentine, and the muriated tincture of iron, may be used as substitutes, with a reasonable hope of success. As adjuvants, cold applications to the anus, perineum, and the hypogastric region should not be neglected.

Sometimes marked relief has followed the exhibition of Ruspini's

styptic, as it is termed. In a case treated by Mr. Brodie, in which a frightful hemorrhage was connected with a very diseased prostate, it promptly arrested the discharge after all other remedies had failed. The skin had become pale, the pulse was feeble, and the patient was exhausted; yet the bleeding continued. "Large quantities of blood were drawn off with the catheter; nevertheless the bladder continued to become more and more distended with blood, and was felt prominent in the belly as high as the navel. All other remedies having failed, I gave the patient a dose of the nostrum known by the name of Ruspini's styptic, and repeated the dose two or three times in the course of the next twelve hours. In about half an hour after the first dose was taken, the hemorrhage ceased, and it never recurred."¹ I have no experience with this remedy, and I mention it here solely on the authority of Mr. Brodie, which, in all matters pertaining to the urinary organs, is of the highest character. The dose is not mentioned by the London surgeon.

CHAPTER IX.

CALCULI OF THE PROSTATE.

THE prostate, like the bladder and the kidney, is liable to the formation of calculi, which generally become a source of severe suffering, imperiously demanding surgical and other interference. They are entirely different, both in their structure and composition,

Fig. 153.



from vesical concretions, and appear to be the result, at least in most instances, of disordered follicular secretion, dependent, in all probability, upon subacute or chronic irritation. The annexed engraving, from Marcet, conveys a good idea of the situation, size, and form of these little bodies.

Old persons are most prone to the formation of these concretions; they may, however, occur at almost any period of life. A few years ago, I met with an instance in

¹ Brodie's Select Works, p. 100. Phila., 1847.

a young man of twenty; and others have seen the affection at a still earlier age.

Physical and Chemical Properties.—In their number, the concretions vary in different cases from a solitary one to several dozens. Marcet¹ gives an instance of upwards of one hundred; and Cruveilhier² met with one in which there were so many that they could not be counted. A similar example is recorded by Sir Benjamin Brodie, in his work on the urinary organs. In general, however, the number of these bodies is small, not exceeding, perhaps, six, eight, ten, or a dozen.

The volume of these bodies, like their number, is liable to considerable diversity. In general, they are diminutive. The smallest are commonly not bigger than an ordinary pin's head, and the largest rarely exceed the size of a pea. In some instances, they have been found of the volume of a hazel-nut, a horse-bean, a chest-nut, and even a pullet's egg. Their size is generally in an inverse ratio to their number; being very small when there are many, and comparatively bulky when they are single. In a remarkable case, observed by Mr. Herbert Barker,³ of England, the concretion weighed three ounces and a half, and consisted of twenty-nine pieces, closely soldered together, and forming, when put in their natural relations, a mass measuring nearly five inches in length, and of an elongated conical shape. It was removed from a man aged twenty-six, who had labored under incontinence of urine ever since his fourth year.

The figure of these concretions, especially when they are solitary, is usually more or less rounded; if, however, they are numerous, they are apt to be polyhedral, or faceted; in some instances, they are flattened on the sides like a grain of corn; now and then they are elongated, pear-shaped, conical, cuboidal, ramiform, or narrow and constricted at the middle, like an hour-glass. In the case of a young man of twenty, I found them of a regularly pyramidal figure. When there is only one concretion, the surface is generally rough, or finely tuberculated; if, on the contrary, they are numerous, it is always smooth and polished; an appearance evidently produced by their mutual friction. In some instances, these calculi are, as it were, articulated together, the rounded extremity of one being received into a corresponding concavity of another.

¹ Essay on Calculous Disorders, pl. ix. London, 1817.

² Anatomie Pathologique du Corps Humain, livraison xvii. &c.

³ Trans. of the Provincial Med. and Surg. Association, N. S., vol. iii p. 285. 1847.

Prostatic calculi exhibit no uniformity in respect to their color. The most common tints are brownish, yellowish, grayish, and reddish-brown. Sometimes they are of a blackish, greenish, marbled, or mottled complexion. Their interior is usually a few shades lighter than the surface. During their development, they become covered with a brownish film from the natural secretion of the gland.

Their consistence is firm, almost or quite equal to that of a urinary calculus. In rare instances, they are friable and pulverulent. In regard to their structure, some are compact, others radiated and laminated. When struck with a steel instrument, they emit a clicking noise, similar to that of a vesical concretion, but more faint.

Marcet and other chemists long ago ascertained that these concretions consist nearly entirely of phosphate of lime; a substance which is sometimes secreted by the prostate in immense quantities, sufficiently, indeed, to give the urine a milky aspect. Lassaigne, who has recently made a quantitative analysis, states that there are contained in 100 parts $85\frac{1}{2}$ of phosphate of lime, $\frac{1}{2}$ of carbonate of lime, and 15 of animal matter. The composition of these bodies would thus seem to be identical with that of salivary calculi. When of large size, they contain, in addition, some of the salts of the urine, and are, therefore, of a mixed character.

Mode of Development.—From a careful examination of these concretions, in the different stages of their development, I am led to conclude that they are originally formed in the follicles and ducts of the prostate, from which they either escape, in whole or in part, as they increase in volume, or they remain, and gradually destroy its substance. I have no reason to believe that they ever arise in the proper parenchyma of the gland. When their number is considerable, at the same time that they are rather bulky, they are apt to break down the intervening structures, and to become aggregated together. In this way, a large sac is sometimes formed, in which the concretions lie like shot in a bag, and the walls of which are of a whitish appearance, and of a fibro-cellular texture. A single cyst of this description occasionally contains as many as twenty, forty, and even sixty calculi, from the dimensions of a mustard-seed to those of a pea, and intermixed with thin, glairy mucus. The changes which accompany the formation of the cyst are always attended by the obliteration of the orifices of the excretory ducts, produced by inflammatory irritation and an effusion of plastic

lymph. The mode of development, in fact, is similar to that which presides over the formation of ranula, lacteal tumors, and serous cysts in other organs. The bag may be solitary, or there may be several, and it varies in its size from that of a currant to that of a pullet's egg.

During the progress of their development, these bodies are liable to produce absorption of the surrounding parts, and to change their situation. Thus, some of them may escape entirely from the gland, and either fall into the bladder, to become the nuclei, perhaps, of a corresponding number of urinary concretions, or they may be excreted along with the urine. Some, again, may become impacted in the orifices of the excretory ducts, or in some abnormal aperture, and project upon the free surface of the urethra, either at its prostatic or membranous portion. Lastly, it is not improbable, that, when they are situated towards the back part of the gland, they may, by continued ulcerative absorption, finally escape into the cellular substance between it and the rectum. Such an event, however, must be extremely rare.

Calculi, resembling those now described, are occasionally found in the ejaculatory ducts, which traverse the prostate from behind forwards. It is not probable, however, that they are of the same character; on the contrary, it is more reasonable to conclude that they are derived from the seminal vesicles, which, as is well known, are sometimes, though rarely, the seat of a peculiar form of concretion. I have myself seen one well-marked example of this, in a young man of twenty.

Symptoms.—There is no uniformity in the effects produced by these bodies, either upon the urinary passages, or upon the system at large. When small, they seldom cause much uneasiness, sometimes, indeed, not the slightest, and it is, therefore, not surprising that their presence should often be overlooked during life. This may be the case, even when they exist in considerable numbers. At times, however, they are productive of great inconvenience, if not of excessive suffering. One of the most common symptoms is a dull, aching, wandering pain, with a sense of uneasiness in the perineum and neck of the bladder; this is frequently attended with difficult micturition, and is liable to be aggravated whenever there is the most trifling derangement of the general health. During the progress of the disease the bladder becomes highly irritable; there is a constant desire to urinate, and the water is loaded with thick, glairy mucus, very much as in catarrh. Occasionally the concre-

tions encroach so much upon the prostatic portion of the urethra as to give rise to partial, and sometimes even complete retention of urine. In a case mentioned by Sir Astley Cooper,¹ the calculi, of which there was an immense number, produced not only painful feelings in the perineum, but a degree of irritation which kept the patient in a state of continual mental excitement, bordering on insanity. The suffering occasioned by these bodies is usually not constant; on the contrary, after having persisted for some time, it may cease altogether, or recur only at long intervals.

I do not deem it necessary to say anything in particular respecting the general symptoms of prostatic calculi, inasmuch as they do not, usually, differ materially from those which accompany stone in the bladder. The health frequently continues good for many years, with the exception, perhaps, of an occasional paroxysm of fever, loss of appetite, and disorder of the bowels. By and by, however, it begins to decline, and at length, after years of suffering, it is completely shattered. A young man of the name of Roberts, of East Tennessee, whom I attended eleven years ago, suffered as severely as any human being possibly could from this disease, under which he had labored from early infancy. He was literally reduced to a skeleton, and had not strength enough to walk across his room. He had an incessant desire to void his water, with excessive scalding and burning of the urethra, and was constantly pulling at his prepuce, which was the seat of a most distressing pain and itching. I sounded him repeatedly without detecting any stone in the bladder, the coats of which were evidently much thickened, and the capacity greatly diminished. In the prostatic portion of the urethra the instrument always encountered a mass of hard substance, emitting a distinct noise, and easily felt by a digital exploration of the rectum. On one occasion I detached several calculi, which were afterwards excreted with the urine, and were found to be of a regular pyramidal shape, smooth and polished on the surface, of a dark brownish color, and of the size of a very small grain of corn. The patient was too much exhausted to justify an operation, and I therefore sent him home, where he soon after died. His body was not examined.

Diagnosis.—From the preceding remarks it will be perceived that the diagnosis of prostatic calculi is by no means always easy. The rational symptoms are, in truth, of little account in the determina-

¹ Lectures on Surgery, by Tyrrell, p. 321. Phila., 1835.

tion of the question; for, like those of vesical calculi, they may be simulated by other affections in so embarrassing a degree as to render them utterly worthless. We have already seen that the detection of these bodies, even when they exist in considerable numbers, is often entirely fortuitous. They are particularly liable to be overlooked when they occur in union with urinary calculi, stricture of the urethra, or hypertrophy of the prostate. When bulky or numerous, or when many of them are aggregated together, and lodged in a large cyst, or finally, when they project, as they now and then do, upon the free surface of the urethra, or into the bladder, they may be detected by a digital examination of the rectum, and the introduction of a sound, bougie, or catheter. As the instrument glides along, it rubs against the foreign body, and imparts to the fingers a distinct grating sensation. If it consist of steel, the concretion may not only be felt, but it will be apt, if struck, to yield a sharp, metallic click, similar to that elicited by the contact of the sound with a urinary calculus. If a smooth wax bougie be used, its surface will sometimes be rendered rough by its collision with the extraneous body.

When the finger is introduced into the rectum, the prostate being at the same time pressed backwards with a sound or silver catheter, the concretions may often be felt as so many hard, irregular projections, the position of which remains unchanged by any force that can be applied to them. They move neither laterally, forwards, nor backwards, as generally happens in vesical calculi. When a considerable number are collected together in a nest, they give the finger the feel of a bag of marbles, of a mass of clotted blood, or of a bag of air; and, if struck with a sound, they produce a sort of dull, jarring, crepitating noise. Sometimes a concretion of this kind is discharged along with the urine, when a careful examination of its character promptly reveals its true nature and origin. In all cases of doubt, chemical tests should be employed.

Another sign upon which great reliance is to be placed, is the circumstance that the concretion can be felt only in one particular spot, and that it is generally immovably fixed, or nearly so. Whatever posture the patient may assume, the situation of the foreign body remains unaltered; it is always there, and nowhere else. In this respect, a prostatic calculus differs remarkably from a vesical calculus, which is liable to change its situation not only with every variation of posture, but also according to the state of repletion and vacuity of the bladder.

Complications.—The calculi under consideration are usually associated with disease of the urinary apparatus. The most common affections are, 1. Stricture of the urethra. 2. Enlargement of the prostate. 3. Stone in the bladder. 4. Hypertrophy of the muscular coat of the bladder. 5. Organic lesion of the ureters and kidneys. The gland in which they are situated is not always hypertrophied; on the contrary, it is sometimes considerably wasted, and even entirely changed in its substance, being converted into a thin, fibrous shell, destitute, in great degree, of the normal structure. Its consistence, in this affection, may be natural, diminished, or augmented. The concretions may occur in any part of the gland, and sometimes they are scattered through its entire substance. Occasionally, though rarely, they are found almost exclusively in the middle lobe, which is then in a state of hypertrophy. A single calculus sometimes extends from the prostate forward into the membranous portion of the urethra, which is thus often dilated many times beyond its natural caliber. The late Mr. James Wilson,¹ of London, alludes to a case in which several concretions of this kind were discharged through an abscess in the perineum; and examples are recorded in which they found their way into the rectum.

Causes.—Of the remote causes of calculous formations of the prostate, nothing certain is known; and, in the absence of facts, it would be idle to indulge in speculation. They are probably of the same nature as those which regulate the development of stone in the bladder. The immediate cause is a deposit of phosphate of lime, in consequence of an excess of this substance in the secretion of the gland. The urine has no agency whatever in their production; and it is important to remember, as was previously intimated, that they are entirely dissimilar, in every essential particular, to vesical calculi.

It is proper here to allude to a variety of concretion of the prostate, which has usually been regarded, though, as I conceive, erroneously, as altogether distinct from the preceding. Mr. Quekett, of England, who has recently examined it with much care, states that it frequently exists in such immense numbers as to seem almost to be a part of the natural secretion of the gland, in the minute follicles of which it is developed. It is of a white, brownish, red, or deep yellow color; and its consistence varies from that of suet or wax to the firmness of fibro-cartilage, sand, or stone. The volume

¹ Lectures on the Urinary and Genital Organs, p. 855. London, 1821.

of these bodies is so minute that it generally requires the aid of a microscope to detect them; it is for this reason that they often elude the eye of the observer. Their chemical constitution, which probably varies in the different stages of their evolution, has not been determined.

I cannot suppose that these concretions possess anything peculiar; on the contrary, I think it must be admitted that they are merely rudimentary calculi, which, during the progress of their development, acquire all the characteristic features which have been here ascribed to them.

Treatment.—In the treatment of prostatic calculi, not much is to be expected from the employment of internal remedies, beyond the good effects which they may exert upon the general health, which must of course always receive due attention. So far as our present knowledge is concerned, there are no medicines, in whatever form or mode they may be exhibited, capable of dissolving bodies of this kind. Any complications that may exist must be met upon general principles; strictures of the urethra must be removed, vesical calculi extracted, morbid sensibility of the bladder corrected, the bowels opened, and the diet regulated. To counteract the tendency to phosphatic deposits, the different acids, especially the nitric, must be put in requisition, either singly, or jointly with infusion of uva ursi and hops, buchu, or pareira brava. Alkalies are indicated where there is marked acidity of the stomach, a sour state of the urine, and excessive irritability of the mucous membrane of the bladder, with a constant desire to pass water.

The radical treatment, which is of course purely mechanical, must be regulated by circumstances. When the calculus projects into the urethra, it sometimes admits of being detached with the sound or catheter, and pushed back into the bladder, from which, if it be not too bulky, it is afterwards discharged along with the urine. To facilitate the separation it will be found useful to introduce the finger into the rectum, so as to steady the gland, and bring it thus more fully within reach of the instrument. When the concretion projects from the gland, but is firmly fixed in its substance, an attempt may be made to seize and extract it with Weiss's forceps, employed upon the same principle as in calculus of the urethra. Civiale and others have repeatedly succeeded in dislodging phosphatic concretions with the litholabe, first detaching them, and then removing them either whole or piecemeal, as in the operation of lithotripsy.

When the calculi are encysted, or contained in a bag in the parenchymatous substance, the only way in which they can be approached is to cut down to the organ upon the staff, as in the ordinary operation of lithotomy. The operation is not difficult; nor is it attended or followed by any ill effects. When the concretion is of large size, and projects forward into the urethra, so as to prevent the possibility of introducing the staff, the lateral operation should give way to the median, as was long ago advised by Dionis,¹ and as has been recently practised by Mr. Herbert Barker,² in the remarkable instance already mentioned. In case there are several bags, situated in different parts of the prostate, a corresponding number of incisions may be required, and these may be made either at the same or at different periods. Before resorting to an operation of such magnitude and importance, the surgeon should always determine, if possible, the precise locality of the foreign bodies; otherwise, after he has made the necessary incisions, he may experience much difficulty in finding the object of his search, or be greatly embarrassed, if not completely foiled, in his attempts at extraction. Occasionally the calculi lie in the cellular substance between the prostate and the rectum, having passed thither by ulcerative absorption. In such a case, instead of cutting through the perineum, as under ordinary circumstances, I should prefer making an incision through the bowel; a proceeding which would be considerably facilitated by dilating the tube freely with the speculum.

CHAPTER X.

PHLEBOLITES OF THE PROSTATE.

THE veins, in different regions of the body, are liable to the formation of earthy concretions, which are hence denominated phlebolites, that is, literally, vein-stones. They are not unfrequently met with in the vessels of the vagina and uterus, and in the venous plexus of the prostate. As occurring in the latter, they are chiefly observed in elderly persons, who have long suffered

¹ *Operations de Chirurgie*, par La Faye, p. 221.

² *Trans. Provincial Med. and Surg. Association*, N. S., vol. iii. p. 235.

under disease or irritation of the bladder, the prostate, the urethra, or the rectum and anus. The concretions, which are seldom numerous, and which are either free or adherent, vary in their size from that of a radish-seed to that of a pea; they are of an irregularly globular shape, smooth on the surface, of a pale, grayish color, and of the consistence of chalk or lime. When fractured, they are found to be composed of concentric layers, of the same color as their exterior. Of the chemical composition of these bodies no accurate information has been published; the probability, however, is that they consist of phosphate and carbonate of lime—principally the former—cemented together by a small quantity of animal matter.

A difference of opinion still exists respecting the mode of origin of these bodies. Some imagine that they are developed in the coats of the veins, from which they finally escape into their interior by a partial destruction of the lining membrane; others, on the contrary, believe that they are formed directly from the fibrous matter of the blood itself, a conclusion confirmed by my own dissections. It is certain that they can often be detected almost in the very act of their development; some parts being red and soft like half-coagulated blood, others firm and fibrous, others hard and earthy. The deposition of inorganic matter may begin either at the centre or at the periphery, or simultaneously at both.

The veins in which these stones are found are generally more or less dilated, tortuous, and hypertrophied. In some instances, they are obliterated both above and below the seat of the concretion, which is thus included as it were in a sort of cyst.

There are no symptoms by which the existence of these vein-stones can be recognized; nor have we any knowledge of the causes which predispose to their formation.

PART III.

DISEASES AND INJURIES OF THE URETHRA.

CHAPTER I.

MALFORMATIONS AND IMPERFECTIONS OF THE URETHRA.

THE urethra is liable to a variety of malformations, which, although exceedingly rare, ought, nevertheless, to be known, on account of their practical relations. The subject is, unfortunately, involved in no inconsiderable degree of mystery, from a disposition in the profession, so remarkable in former times, to exaggerate the most trifling deviations from the natural standard, and to invest them with an importance which does not legitimately belong to them. Another reason, perhaps, is that no individual experience, however large, can be of any material use in elucidating the true character of these defects, and that he who interests himself in their investigation must content himself in playing the part of a compiler. It does not fall within the scope or design of this treatise to present a full and detailed account of this subject; all I shall aim at is an outline of the more important facts in their relation to the surgical pathology of this tube.

The most common vices of this canal may be arranged under the following heads: 1. Malformations of the terminal orifice; 2. Absence, contraction, or obliteration of the urethra; 3. Duplicity of the canal; 4. Changes of form; 5. Deviations from the normal direction.

1. The *urinary meatus*, the anterior orifice of the urethra, is situated at the summit of the penis, where, in the natural state, it forms a vertical slit, the edges of which are slightly rounded off, and of a cherry-red color. This aperture, like the rest of the canal, is subject to certain vices, of which the principal relate to its position, size, form, and number. The aperture is occasionally situated con-

siderably higher up or lower down than in the normal state; and in some instances, and these are by no means infrequent, it is placed upon the upper or under surface of the penis; in the former case, the malformation constitutes what is called epispadias, in the latter, hypospadias. I have seen no example in which the orifice was situated at the side of the median line of the gland. The urethra sometimes terminates at the inferior portion of the abdomen. Haller refers to an instance in which it opened in the inguinal region; and Geoffroy Saint-Hilaire mentions one where the meatus was situated in the right groin.

The meatus, instead of presenting itself in the form of a vertical slit, is sometimes of a rounded, circular, or ovoidal configuration. Its size may also be unnatural. Thus, it is sometimes remarkably large, or so small as hardly to admit the extremity of an ordinary silver probe. In the former case, which is rather rare, it constitutes a predisposition to gonorrhœa and chancre, from the fact that it offers an unusually wide surface for the contact and lodgement of the specific virus.

The meatus is sometimes double, and even triple; a circumstance which has led to a belief, at one time common enough among anatomists, of the existence of a double urethra. In the celebrated case of Fabricius Hildanus, so often cited in support of this opinion, there were two openings on the head of the penis, but only one canal. Vidal relates an instance in which there were three orifices, two of which pierced the gland, while the other was situated at the lowermost part of the navicular fossa, nearly at the base of the frænum. The latter was quite capacious, and afforded vent both to the urine and the semen; the rest were very small and contracted, and permitted the urine to pass only when this fluid was ejected with unusual force.

The orifice is occasionally occluded, either partially or completely. In the former case, the narrowing may be effected by an unusually small opening with inverted edges; in the latter, by an extension of the mucous membrane, or of the mucous membrane and a small quantity of the proper structure of the gland.

A similar arrangement occasionally exists in the urethra of the female. More generally, however, the occlusion is a consequence of the union of the pudendal lips. A very rare and interesting case of closure of this tube, associated with patency of the urachus, was observed by Berthélemi Cabrol, of Montpellier, in a girl, eighteen years old. The urine had escaped, ever since birth, at the

inflammation, which projected about four inches from the abdomen, and emitted an intolerable stench.

2. The urethra may be *absent*. Of this occurrence the best marked example is seen in that variety of extrophy of the bladder in which the urine and semen are discharged above the pubes. This species of malformation is exceedingly rare, and is necessarily accompanied with impotence. The tube in question is sometimes preternaturally narrow, or completely occluded. The defect may involve the entire canal, or it may be limited to a particular portion. Julius Cloquet met with an instance in a new-born child, in which the contraction existed at the middle of the urethra, and was upwards of an inch in length. The passage is occasionally closed by a prolongation of the mucous covering of the head of the penis; or by an internal septum, formed by a duplicature of the lining membrane; or, finally, by a sort of cellulo-fibrous substance. These varieties of occlusion of the urethra bear the greatest possible analogy to those of the rectum, and require the same modes of treatment for their relief.

3. Many authors speak of what they regard as a *double urethra*. Vesalius mentions the case of a young nobleman, who had two canals of this kind, one for the transmission of the urine, the other for the passage of the semen. Other instances are narrated in which one of the tubes, after extending some distance back, terminated in a cul-de-sac. Such an anomaly, of which practitioners have recorded numerous examples, may be congenital, or acquired, more commonly the latter, in consequence of the maladroit use of instruments, eventuating in the formation of a false passage. Vidal,¹ who has carefully studied this subject, by an analysis of the more important published cases, has arrived at the following conclusions respecting it: first, that the actual state of the science warrants the belief that the head of the penis may have several orifices instead of one; and secondly, that certain facts authorize us to admit the occasional existence of two canals; but that there is no instance, of a well authenticated character, which tends to show that there has ever been a double urethra, properly so termed; or, in other words, two separate and distinct channels for the transmission of the urine and semen.

4. The tube is liable to *changes of form*. These seldom pervade the entire canal, but are limited to particular portions of its extent. Of these, the navicular fossa is, perhaps, most frequently affected.

¹ Pathol. Externe, t. v. p. 11.

This part, which is naturally very wide, is sometimes absent, so that the spongy portion of the urethra is throughout of the same uniform dimensions. At other times, though very rarely, the fossa is remarkably dilated, or expanded into an elongated pouch, which may thus serve as a temporary reservoir for the urine, the seminal fluid, and even calculous concretions, especially when it happens to be conjoined with an unusually narrow meatus. If, on the contrary, the meatus is very capacious, as when it extends as far as the base of the gland, constituting the first degree of hypospadias, it may form a serious inconvenience, inasmuch as it predisposes the part to the venereal infection by affording lodgement to gonorrhoeal and chancrous matter.

The bulbous part of the canal is occasionally unnaturally dilated, forming a species of cul-de-sac, well calculated to arrest the point of the catheter, and impede its progress towards the bladder. In some cases, very few, however, in number, this part presents an unusually projecting septum, equally calculated to embarrass the operator.

The sinus in front of the verumontanum is sometimes so much enlarged as to be capable of receiving the end of a very large catheter; and a similar expansion is occasionally seen at each side of this crest.

In some instances, the verumontanum is prolonged much further back than usual, giving rise, by a species of expansion, to two lateral folds, which are continuous in front, and resemble two little valves. An analogous arrangement sometimes exists towards the membranous portion of the urethra, but in this case the concave margin of the valve-like process looks towards the bladder instead of forwards. This variety of malformation, which is probably sometimes the result of disease, was first delineated by Langenbeck in his memoir on lithotomy, and has been particularly noticed by Velpeau in his *Surgical Anatomy*. Lisfranc states that he has several times seen a depression between the two lateral lobes of the prostate. In one of his cases, the abnormal cavity was two lines in length, a line in width, and a line and a half in depth: the gallinaginous crest was deformed, and directed towards the right side.¹

5. The tube sometimes deviates from the *normal direction*. In the infant, in whom the bladder is elongated, and situated, in a great measure, in the abdominal cavity, the tube is a good deal more

¹ Vidal, *Pathol. Externe*, t. v. p. 7.

curved than in the adult. It is also influenced, in some instances, by the height and shape of the pubes. In the foetus, according to Chaussier, its curvature is often augmented by the distension of the rectum by the meconium.

Cases occur in which the tube terminates in the bladder a little lower down than usual; a circumstance which materially diminishes the bas-fond of the bladder, and predisposes to incontinence of urine. The prostatic portion of the urethra occasionally runs through the gland of that name in such a manner that nearly the whole of that body lies above it. In such a case, the tube is in close contact with the rectum, which must thus be endangered in the operation for stone. In some instances the reverse of this is the case, the tube being lodged in a mere gutter in the upper surface of the gland. I am not aware that any lateral deviations have been observed; if any occur, they must be exceedingly infrequent.

Effects.—One of the most common, and at the same time one of the most serious, effects of congenital obstruction of the urethra is excessive distension of the bladder, with enlargement of the ureters, and organic disease of the kidneys; consisting, for the most, in a peculiar cystiform dilatation of their substance. These alterations also show, what has not been admitted by all physiologists, that micturition is naturally performed before birth, and that the secretion of urine may be carried on even after the renal tissues are almost entirely destroyed. I subjoin the following cases, already published in my work on *Pathological Anatomy*, in illustration of the interesting facts just mentioned.

Heer,¹ a German author, describes a case where the obstruction existed near the neck of the bladder, in the form of a membrane. The closure was complete. The bladder was excessively distended, and the ureters and pelves of the kidneys enormously dilated. The parts are preserved in the Meckel Museum at Halle.

Sir Benjamin Brodie² saw a full-grown male foetus with the orifice of the urethra congenitally deficient, and the bladder, ureters, and renal pelves all a good deal distended by a fluid which possessed all the properties of urine, except the want of uric acid. Dr. Ivanhoe, of St. Petersburg, dissected a child, born at the full period, which lived forty-eight hours with the urethra imperforate, and the bladders and ureters much distended.³

In a case by Dr. Robert Lee,⁴ of London, the child was born at the eighth month; it had double harelip, and clubbed feet; the abdomen was enlarged, the ureters were

¹ De morb. Renum, p. 14.

² Treatise on Urinary Complaints, &c., by John Howship, 1823.

³ Medico-Chir. Trans. of London, vol. xix., Paper by Dr. Lee.

⁴ Medico-Chir. Trans. l. c.

dilated, and the renal pelves contained, the one four, the other nine ounces of a fluid which exhibited all the characteristic properties of urine.

Mr. Howship¹ examined a male child, which was born alive at the eighth month, but died in a few hours. It had distorted feet, with imperforate anus, and the urethra, near the bladder, was impervious for a quarter of an inch. The bladder contained eight ounces of clear limpid urine, and its coats, which were remarkably thick, had yielded posteriorly so as to form a pouch. The ureters were as large as the finger, distended and contorted; and the kidneys, which were entirely divested of their natural structure, were converted into numerous cysts, not exceeding the volume of a garden-pen, and loosely connected together by cellular substance.

In the case described by Mr. T. W. King,² of London, the fœtus was supposed to have been more than four months old. The abdomen was distended, and contained about a quart of fluid, opaque, viscid, and of a dusky-reddish color, with numerous flakes of fibrinous matter floating in it. The bladder, which reached to the umbilicus without any appearance of a distended urachus, was large, and might have contained, originally, rather more than half a pint of water; its coats were much hypertrophied, and the general figure of the sac was globular, with a small cell extending into the prostate, as if it were the commencement of a urethra. Beyond this there was no excretory canal. A little behind the summit of the bladder the tunics were very much attenuated, and here a simple fissure existed, rather less than half an inch in length, which opened into the peritoneal cavity. The ureters, which were tortuous and somewhat thickened, were enlarged, chiefly inferiorly, much beyond the capacity of these tubes in the adult. The kidneys were small, slightly lobular, and not materially affected within by pressure.

A similar example is recorded by Billard.³ The child was a still-born male; the bladder was enormously distended by a white fluid, and the urethra was obliterated at its posterior part; there was no prostate gland; the lower orifices of the ureters were perfect, but the diameter of these tubes was much increased, and the kidneys were nearly as large as a hen's-egg, and considerably altered in their structure. There was no anus, and the rectum, examined internally, presented a complete cul-de-sac, closely adherent to the bladder. The other organs were natural.

Treatment.—Many of these defects now described are, of course, irremediable, and are, on this account, more interesting to the physiologist and pathologist than to the surgeon. There are some of them, however, which admit of relief, and which, therefore, require further notice in this place.

Occlusion of the *external meatus* of the urethra must be speedily remedied by an operation, otherwise the urine may accumulate to so great an extent as to lead to a rupture of the tube, with an infiltration of the fluid in the connecting cellular tissue. Unfortunately the existence of this malformation cannot always be at once determined, on account of the narrow and elongated condition of the prepuce, which prevents the inspection of the affected part. It is only,

¹ *Op. cit.* p. 374.

² *Guy's Hospital Reports*, vol. ii. p. 508, 1837.

³ *Treatise on the Diseases of Children*, translated by Dr. Stewart, p. 344.

in general, in consequence of the absence of micturition, and the presence of a small, elastic, and translucent swelling behind the head of the penis, that attention is directed to the seat of the malformation, and the proper means of overcoming it. When the occlusion is caused simply by a duplicature of the lining membrane, forming a sort of hymen, septum, or diaphragm, a vertical incision in the direction of the natural outlet will generally suffice to afford relief; the precaution being observed to keep the edges of the wound apart with a tent of slippery elm, or a silver tube, so arranged as to prevent it, on the one hand, from slipping out, and, on the other, from passing backward into the bladder. When, on the contrary, the imperforation depends upon the presence of a fibrous tissue, and reaches a considerable distance back, the operation will be more serious, and will require to be performed with a trocar, the canula of which, or a proper substitute, may be employed afterwards to keep the canal pervious.

In the extraordinary case observed by Berthélemi Cabrol,¹ where the occlusion was combined with patency of the urachus, a cure was effected by dividing the abnormal septum, and retaining a catheter in the bladder for conducting off the urine. The day after the operation, the surgeon threw a strong ligature around the tumor at the navel, and then cut off the redundant portion, the raw surface being immediately touched with the actual cautery. As soon as the eschar was detached, the sore was dressed with a healing salve, and in less than a fortnight the cicatrization was completed.

When the occlusion depends upon union of the pudendal lips, a tedious dissection may be necessary to expose the concealed outlet. The incision should be made directly along the middle line, and the operation may be finished, if necessary, with the trocar.

The malformations known under the names of *hypospadias* and *epispadias* are defects of a serious character, as they entail not unfrequently great suffering and inconvenience upon their unhappy subjects. From the manner in which the urine is discharged, the neighboring parts are kept continually in a tender, irritable, and excoriated state; at the same time that they exhale so unpleasant an odor as to render the patient disagreeable both to himself and to those around him. But, what is worse than all, they often render the individual impotent, and thus disqualify him for matrimony. This must necessarily be the case whenever the defect exists far

¹ Observat. Anatom. 23.

back, and is so great as to allow the whole of the semen to escape at the preternatural aperture; or where the fissure extends all the way from the pubic symphysis, or the perineum, to the head of the penis. Examples of this description are, therefore, of the deepest interest in a medico-legal point of view; for, although the subjects of them may be able to copulate, yet, from their inability to project the semen into the uterus, the intercourse cannot prove fruitful. When the malformation is associated with shortening and incurvation of the penis, or excessive length of the member with great redundancy of the prepuce, even copulation may be impracticable. Hypospadias and epispadias occasionally, though rarely, coexist.

Hypospadias presents itself under three varieties of form, of which the most common, as well as the most simple, is the one in which the urethra opens just behind the frænum; it is generally accompanied by a fissure of the gland, which is destitute of a natural orifice, and has a broad, flattened, and unseemly appearance. In the second form, the tube opens at some point intermediate between the first and the scrotum; and in the third, the urethra terminates at the latter organ, which is cleft at the middle line, so as to form two lobes, closely resembling the pudendal lips. In the second variety of the malformation, the urethra extends occasionally as far forwards as the crown of the penis, where it ends in a sort of cul-de-sac.

In the more simple variety of hypospadias, a cure may be attempted by paring the edges of the fissure, and uniting them by means of interrupted sutures over a catheter introduced into the bladder. The sutures should be placed near each other, and the intervals between them should be carefully closed with strips of isinglass plaster, or, what is better, collodion, or the article sold in the shops under the name of Comstock's liquid cuticle. They should not be removed before the end of the sixth day, by which time the greater portion of the wound will have pretty firmly united. Any part that may remain unclosed may be touched with nitrate of silver, to induce the formation of healthy granulations. The same mode of proceeding is adopted when the fissure exists further back, only that it will be necessary, in addition, to establish an artificial urethra by means of a trocar, pushed in the direction of the natural channel. The canal thus made is kept pervious by the catheter, until it has received a mucous lining, after which the instrument should be worn a few hours every day for a number of months, to prevent undue contraction, which is so apt to follow all operations

of this kind. When there is much deficiency of the parts, autoplasty may be necessary; the gap being filled up by borrowing a piece of integument from the scrotum or perineum.

When hypospadias is complicated with great shortening of the spongy substance of the urethra, accompanied with incurvation of the penis, the defect may sometimes be remedied by cutting out a V-shaped piece of the cavernous bodies, at their dorsal surface. Such an operation was performed successfully, many years ago, by the late Dr. Physick, and also, in 1844, by Professor Pancoast, of Philadelphia. It may be divided into three stages. In the first, the skin of the dorsal surface of the penis is pinched up longitudinally, and then divided transversely by transfixing its base. Secondly, the cavernous bodies being thus exposed, a wedge-shaped piece, from half an inch to an inch in length, according to the extent of the incurvation, and embracing about two-thirds of the thickness of the two cylinders, is excised with the bistoury, by carrying the instrument in a sloping direction, first from behind forwards towards the gland, and then backwards towards the pubes. The hemorrhage is usually slight, and ceases of its own accord. Lastly, the edges of the triangular wound are tacked together by several points of the interrupted suture; after which the penis is placed in a hollow, well-padded splint, to which it is secured by an appropriate roller. Cold water dressings are applied, to prevent undue inflammation, and the stitches are removed at the end of the fifth, sixth, or eighth day, according to the degree of the reunion.

In a case of hypospadias, accompanied with considerable incurvation, which was under my charge some years ago, I dissected off the integuments at the seat of the bend, and then made four horizontal incisions, at intervals of several lines, into the fibrous sheath of the cavernous bodies, in order to restore them to their normal length. The operation had the effect intended, but, in consequence of the difficulty of keeping the organ extended, there was a reproduction of the curve within a very short period after the cicatrization of the parts.

In *epispadias*, which is much more rare than hypospadias, the malformation affects the dorsal surface of the penis, and likewise presents itself under several varieties of form. In the subjoined sketch, copied from Liston, the fissure extends from the pubic symphysis to the extremity of the penis, which has a singularly flattened and distorted appearance. The mucous membrane, in this condition of the parts, is generally abnormally pale, and its lacunæ

are beautifully distinct. In the more simple forms of epispadias, the urethra terminates a short distance behind the gland of the penis, which is usually more or less disfigured. The treatment for the rectification of these defects is to be conducted upon the same principles as that for the different varieties of hypospadias, already described. In Mr. Liston's case, in which nearly four inches of the urethra were exposed, a complete cure was effected in a few days. The operation consisted in paring the edges of the cleft thoroughly, and putting them together over a catheter, by means of many points of the twisted suture. Union by the first intention took place in the entire track, except near the pubes, where a very minute fistulous opening remained, through which not more than a drop of urine oozed during micturition. This was afterwards closed with a heated needle. The organ was in all respects, and for all purposes, as perfect as could be desired.¹

Fig. 154.



CHAPTER II.

LACERATION OF THE URETHRA.

THE urethra, like other mucous canals, is liable to laceration; and the lesion, although not common, is of sufficient importance to merit attention in a work specially devoted to the injuries and diseases of the urinary organs. The subject is the more deserving of consideration here, because it has either been entirely overlooked in most of our systematic treatises on surgery, or noticed so cursorily

¹ Practical Surgery, p. 573. London, 1840. I take much pleasure in referring here to a valuable paper on hypospadias and epispadias by Dr. Mettauer, an eminent surgeon of Virginia, in the *American Journal of the Medical Sciences* for July, 1842. The operation performed by this gentleman upon one of his patients was both novel and ingenious, and is worthy of imitation in similar cases.

as to afford no satisfactory information. The omission can be explained only by the fact that few writers have any practical knowledge of the lesion, and that no analysis has yet been made of the cases which are scattered through our periodical literature. The best work on the subject, so far as my information extends, is a little monograph of Dr. J. Franc, published at Montpellier, in 1840, under the title of *Observations sur les Rétrécissements de l'Urètre par Cause Traumatique*. There is also a short but valuable paper on laceration of the urethra, by Dr. Isaac Hays, of Philadelphia, in the nineteenth volume of the *American Journal of the Medical Sciences*, of which he is the able and distinguished editor.

Causes.—Rupture of the urethra is produced by two varieties of causes, the one acting from without, the other from within. Under the first may be comprised falls, blows, and kicks upon the perineum, or the perineum and the penis; under the second, injury done by the lodgement of a calculus, and the rude, forcible, or injudicious use of catheters, bougies, and sounds.

In the majority of instances, the laceration is caused by falls from a considerable height, in which the perineum strikes against some sharp, angular, or projecting body, while the thighs are more or less separated from each other. From the peculiar character of their occupation, sailors, masons, carpenters, painters, house-cleaners, coachmen, and teamsters are more prone to this kind of injury than any other classes of individuals. Sometimes the laceration is occasioned by a blow or kick upon the perineum, from the foot of a man or a horse; and a case is mentioned, in the *London Medical and Physical Journal* for May, 1809, in which it was produced by the person being thrown forcibly forward on the pommel of his saddle. It need hardly be added that balls and other missiles are capable of causing the injury in its most aggravated form.

Of the internal causes of laceration of the urethra, the most common are vesical calculi, bougies, and catheters. After lithotripsy, serious injury is often inflicted by sharp, angular fragments of stone impinging against, and rupturing the mucous membrane; and the same circumstance occasionally occurs when a small, but rough calculus, in its attempt at extrusion, becomes impacted in the posterior portion of the tube. The mischief which is sometimes done to the urethra in the rude introduction of the catheter, bougie, and sound, is familiar to every one. Laceration of this canal has occasionally taken place under a violent erection, especially if the penis,

while in this condition, happened to be struck accidentally against a hard and resisting body.

The urethra occasionally gives way, in a very singular manner, during convalescence, after attacks of fever. Mr. W. P. Ormerod¹, of London, has recently called attention to this subject, detailing three cases in illustration of it. The patients who had been ill of low fever were seized during their recovery with swelling of the genitals, attended with evident effusion of urine. Two died. In one of these, the urethra was carefully inspected without detecting any stricture; but there was an opening in the membranous portion of the tube, with dark ragged margins, which, as Mr. Ormerod suggests, might possibly have included it. The probability is, that slight stricture had existed in all these cases, and that it had become softened and ulcerated during the progress of the fever, thus eventually permitting the urine to diffuse itself through the connecting cellular tissue. The possibility of such an occurrence should be borne in mind by the medical practitioner, in order that the patient may not be lost for the want of proper treatment, namely, early and free incisions.

Seat.—The laceration varies, as to its seat, according to the nature of the vulnerating body, or the character of the exciting cause. When it results from a blow, fall, or kick upon the perineum, it occurs usually immediately in front of the triangular ligament, between it and the bulb; occasionally, it is situated behind this point; and sometimes, though rarely, it is met with in the spongy portion of the tube. When the rupture is caused by the passage of a calculus, or of an instrument, it may be seated in any region of the urethra, from the neck of the bladder to the external orifice.

Extent.—There is no uniformity in regard to the extent of this injury. While in some instances it is extremely slight, presenting itself perhaps merely in the form of a minute fissure, slit, or crevice, in others it is so great as to embrace one-half, two-thirds, or even the entire circumference of the tube. In the latter case, the ends of the divided canal frequently lose their apposition, and thus oppose a serious, if not an insurmountable, barrier to the introduction of the catheter. The laceration may be limited to the mucous membrane, or it may involve along with it all the tissues which intervene between the canal and the external surface, according to its seat, and the nature of the vulnerating body. Finally, it may be solitary or multiple, longitudinal, transverse, or oblique.

¹ Clinical Collections and Observations in Surgery, p. 167. London, 1846.

Symptoms.—The symptoms of this affection are generally sufficiently characteristic. The most prominent are, pain in the affected part, hemorrhage from the urethra, inability to void the urine, or the discharge of this fluid in a small and imperfect manner, discoloration and swelling of the perineum, or of the perineum, scrotum, and penis, and great difficulty, if not utter impossibility, of introducing the catheter. The patient is weak and faint, perhaps sick at the stomach, and labors under all the effects of a severe shock.

The pain is usually in direct proportion to the extent and violence of the accident. It is of an acute, sharp, cutting character, as if caused by a pen-knife, razor, or lancet, is generally circumscribed or limited to the seat of the injury, and is greatly aggravated by the passage of the urine, by motion, and by pressure upon the perineum. It is not intermittent, but constant, and is sometimes compared by the patient to the sensation produced by the contact of molten lead. Although originally circumscribed, it soon extends to the circumjacent parts, as the testicles, groins, thighs, anus, and the bladder, and becomes so severe as not to allow the poor sufferer a moment's comfort.

The hemorrhage varies in quantity from a few drops to a number of ounces, according to the extent of the injury sustained by the urethra and the circumjacent textures. The loss of a pint of blood soon after the accident is no unusual occurrence. The discharge, which is generally transient, sometimes continues for a number of days, and is always aggravated or reproduced at every attempt to introduce the catheter. Occasionally the blood, instead of issuing at the external orifice of the urethra, escapes at the abnormal opening, lodges in the surrounding cellular tissue, or passes back into the bladder, where it is either retained, or, as most commonly happens, dissolved, and excreted along with the urine.

Few patients affected with rupture of the urethra, are able to void their urine with anything like their accustomed facility. On the contrary, there is usually a great deal of difficulty, accompanied with excessive pain and straining, and a constant desire to relieve the bladder. In many cases, indeed, there is complete retention from the very beginning, caused either by the loss of apposition of the divided ends of the tube, by the presence of coagulated blood, or by the disabled condition of the bladder itself. Sometimes, again, though rarely, there is total suppression of urine.

The discoloration of the affected part may occur instantly, or not under a few hours. It varies from light red to deep purple or black,

and involves not only the perineum, but frequently also the scrotum and the penis. The immediate cause of this symptom is an extravasation of blood into the subcutaneous cellular tissue, the quantity of which varies, in different cases, from a few drachms to several ounces. When considerable, it must necessarily lead to proportional distension of the affected region, which is still further increased, in a short time, by the ordinary products of inflammation. Although there are few cases of laceration of the urethra by external violence in which there is not some degree of discoloration of the integuments, it is worthy of remark that the parts occasionally present an entirely natural appearance.

If an attempt be made in this affection to draw off the urine, the catheter will either not enter the bladder at all, or it will meet with more or less resistance at the seat of the injury. Its arrival at this point will be indicated by a peculiar grating sensation, which no experienced hand can possibly mistake. When the laceration is considerable, the extremity of the instrument will be apt to take a wrong direction, or to become entangled by the edges of the wound. If the tube be completely severed, and the divided ends have lost their parallelism, the greatest difficulty will be experienced in performing the operation; and, in many instances, no surgeon, however skilful, will be able to succeed. Should the instrument fortunately reach the bladder, its withdrawal will generally be followed by a renewal of the hemorrhage.

Another bad consequence of laceration of the urethra, especially when produced by external causes, is extravasation of urine into the surrounding cellular tissue. When the accident occurs in the posterior part of the tube, in front of the triangular ligament, the fluid generally distends the perineum, and thence proceeds forwards, underneath the dartos, into the scrotum and spongy body of the penis. In such a case, violent inflammation, often followed by sloughing, and even death, is an inevitable result.

Diagnosis.—When a man has received a fall, blow, or kick upon the perineum, or the genitals, and is almost immediately after seized with a sharp, cutting, or burning pain in the region of the injury, and a discharge of blood from the urethra, it may be pretty positively affirmed that he is laboring under the effects of a laceration of this canal. The diagnosis is fully confirmed, when, superadded to these symptoms, there is a frequent desire to empty the bladder, with an inability to pass a drop of water. -The peculiar grating sensation, previously alluded to, as being communicated to the hand

on attempting to introduce a catheter, is another valuable sign, almost of itself characteristic of the nature of the accident. A mere contusion of the urethra, unaccompanied by any rupture, is easily distinguished from the latter affection by the absence of hemorrhage and of the severe burning pain which results from the contact of the urine. In neither case can any positive conclusions be drawn from the character of the constitutional symptoms, which are often as severe in one of these lesions as in the other.

Prognosis.—The danger of this lesion is usually in direct proportion to its extent, and the state of the bladder at the time it is inflicted. If the laceration is considerable, and the patient has not made water for some time, infiltration will be almost certain to occur, and to be followed by all the mischief which the fluid is capable of producing whenever it comes in contact with tissues which are not accustomed to its presence. The usual consequences of such an accident are, severe pain and swelling of the affected parts, retention of urine, violent rigors, great depression of the pulse, delirium, excessive thirst, and constant restlessness. If the parts be not relieved by early and free incisions, they soon fall into gangrene; hiccup and subsultus ensue, and the patient dies in great agony, generally before the eighth day, and sometimes as early as the fourth or fifth.

In slight cases, the prognosis is always more favorable; but even here the patient can scarcely be considered as being out of danger as long as there is any possibility of urinous infiltration. Apart from this contingency, a wound or rent of the urethra is attended with no more hazard than a similar injury in any other region of the body; it heals quite as readily, and does not give rise to any more suffering. The injury, even when comparatively slight, is sometimes followed by great contraction of the corresponding portion of the tube.

Treatment.—The treatment of this accident must be prompt and decisive, otherwise great, if not irreparable mischief must inevitably befall both part and system. As the chief danger consists in the escape of the urine by the breach of the urethra into the cellular tissue of the perineum and scrotum, every means, calculated to obviate such a calamity, should be instantly put in requisition. If the rent be small, the first thing to be done is to endeavor to pass a catheter into the bladder; an operation which is to be conducted in as gentle and cautious a manner as possible, lest the point of the instrument be intercepted by the wound, and thus take a wrong direction. The catheter should rather be over than under the ordi-

nary size, so that, when introduced, and fixed in its place, it may slightly distend the parietes of the tube, and thereby prevent the urine from flowing between the contiguous surfaces. The object of this proceeding is to carry off the water from the bladder as fast as it arrives there, without permitting it to come in contact with the lacerated surface. Unless this be attained, the treatment must not be thought of, much less employed. It does not matter whether the instrument used is one of silver or of gum, though I always myself prefer the former on account of the greater facility of introducing it, and the less necessity for changing it after it has been some time in the bladder.

If, on the contrary, the rent be very extensive, as is indicated by the hemorrhage and other symptoms, the only rational treatment is to make a large incision into the part, to afford a free exit to the urine, which will otherwise be sure to insinuate itself rapidly into the cellular tissue of the perineum and scrotum. The operation is conducted upon the same principles as that of lithotomy. The patient being placed and secured in the usual manner, a staff or grooved director is introduced into the urethra, and carried down to the seat of the rupture, where it is carefully held by an assistant. Taking the point of the instrument for his guide, the surgeon cuts along the raphé of the perineum, directly over the affected part, until the urethra is completely laid open to any extent that may be necessary. The same precautions, in regard to the wounding of the rectum and the vessels of the perineum, are to be observed here as in puncture of the bladder. When the operation is completed, a catheter is introduced into the bladder through the natural opening of the urethra, and fixed in its situation by a T-bandage. The instrument must be worn until the external wound is healed, else it will be difficult, if not impossible, to restore the canal to its natural condition.

The operation here described is easy of execution, and indispensable to the safety of the patient; it places him at once in a state of comparative security, by preventing urinous infiltration, and affording nature an opportunity of repairing the breach at the least possible expense of time and suffering. No danger whatever is to be apprehended from its performance; and the wound usually heals in a very short time, without the aid of any dressing. When the laceration of the tube is very extensive, but unaccompanied by any external opening, it is often difficult, as has been justly remarked by

Mr. Earle,¹ of London, to persuade the patient or his friends of the necessity of an operation; and, in such a case, "much decision and firmness are required on the part of the surgeon, who should act at once, or he may be too late to prevent extensive or even fatal effusion of urine."

If some hours have elapsed since the occurrence of the injury, as not unfrequently happens when the patient, from ignorance or other causes, neglects to send for surgical aid, and it be apparent, from the nature of the symptoms, that there is urinous infiltration, no time is to be lost in making numerous and deep incisions into the affected parts. A free outlet must be afforded to the pent-up fluid, and to the inflammatory products which so soon succeed to it, otherwise extensive sloughing and even death may be the consequence. Hesitancy, in a case of this kind, must yield to decision; tardiness to promptness; timidity to boldness. The patient is saved or lost in a moment.

The treatment above mentioned, as applicable to the various contingencies connected with this lesion, may often be advantageously aided by general and topical bleeding, purgatives, demulcent drinks, the warm bath, anodynes, fomentations, and poultices. Much judgment is generally required in the adaptation of particular remedies to particular cases. When infiltration is present, depletion is usually badly borne, and should be practised with the greatest circumspection.

It has been proposed in laceration of the urethra, followed by obstinate retention of urine, to puncture the bladder through the rectum or the abdomen. To such a proceeding, which has unfortunately been too often carried into effect, there is great objection; for, even supposing that it relieves the distended organ, it does not strike at the main evil, the urinous infiltration of the surrounding parts. It is better, therefore, always to incise the affected tissues as freely as possible, cutting down to the urethra, and laying it open so as to afford full vent to the urine.

The contraction of the tube which sometimes succeeds to this injury is to be managed upon the same principles as an ordinary stricture. The subject will be adverted to in its proper place.

In the following case, which has been kindly communicated to me by my friend, Dr. Lewis A. Sayre, of New York, and which forcibly illustrates the nature, treatment, and termination of this

¹ London Medical and Physical Journal, April, 1828, p. 317; Amer. Journ. Med. Sciences, xix. p. 898.

lesion, the urethra suffered most extensive destruction, in consequence of external injury, and yet, under the judicious management of that gentleman, perfect recovery took place.

CASE.—A carpenter, aged 24 years, on the 25th of June, 1847, fell from the scaffolding on the third story of a house, a distance of about thirty feet, astride an iron bar, fracturing the pubic bones at their symphysis, rupturing the transverse perineal artery, and contusing most severely the scrotum and buttocks. He was rendered insensible by the accident, and there was a profuse hemorrhage from the urethra. The physician, Dr. George Wilson, who first saw him, introduced a large catheter, from which the blood issued in a full stream for some time after the urine had all escaped, and which was arrested only by plugging the instrument, and enveloping the whole pelvic region in pounded ice.

On the 26th, when Dr. Sayre saw the case in consultation, the bladder was immensely distended; the abdomen, scrotum, penis, and inside of the thighs were of a dark color, from the presence of infiltrated blood; the pulse was quick and feeble; the countenance was very anxious; and there was excessive restlessness, with constant hiccough. A large quantity of urine, strongly mixed with blood, was drawn off, but not without great trouble, as the instrument, on reaching the bladder, became almost immediately obstructed, and had to be removed several times and cleansed. The catheter was now retained in the parts, and a long incision was made on each side of the perineum, to give vent to the effused fluids, especially the urine, which had been copiously extravasated through the cellular tissue.

On the following day, the parts were less swollen and of a better color, and the man was more composed; under the influence of morphia, he had had some sleep, and reaction was fully established, the pulse being, however, still quick. The catheter was not removed until the next morning, when, being eroded around the eyelets, and covered with sandy matter, another instrument was substituted, which, in its turn, experienced the same fate.

In a few days, sloughing commenced in the perineum and scrotum, carrying away nearly the whole of the latter, and completely exposing the testes, as well as the neck of the bladder, the urethra being destroyed for about two inches at its posterior extremity. When the catheter was introduced through the penis, the finger could be easily passed around the curve of the instrument, which hung like a loop in the open ulcer. The patient was kept upon a generous diet; and, after the sloughing had ceased, the parts were dressed with balsam cerate. A large catheter was constantly maintained in the bladder, to conduct off the urine; gradually granulations began to form around the tube, and in four months the opening had entirely closed, the testes being pressed up firmly against the pubes by the new skin.

To prevent the new portion of the canal from contracting, the man was directed to employ a large catheter constantly for some time, and subsequently, at intervals, as long as he lived. As the general health improved, erections returned, and everything progressed in the most satisfactory manner. Dr. Sayre had an opportunity of seeing his patient seven years after the accident. He found him in perfect health, but with a tendency to contraction of the urethra, which he counteracts by the constant weekly use of bougies. On one occasion, he had neglected the employment of the instruments for upwards of a month, and the consequence was that the channel became so much reduced in size that he had serious difficulty in reaching the bladder. He has been married three years, but has no offspring, although his erections and animal passions remain unchanged.

CHAPTER III.

STRICTURE OF THE URETHRA.

By the term stricture is understood a diminution of the caliber of the urethra, either of a transient or permanent character. The affection, in the former case, commonly depends upon a spasmodic contraction of the tube, and is hence known by the name of spasmodic stricture; it lasts only for a short time, is paroxysmal in its nature, and often disappears as suddenly and unexpectedly as it comes on. In the latter, on the contrary, it is always caused by an effusion of plastic lymph into the lining membrane and the subjacent cellular tissue of the urethra, where a portion of this substance remains, and is ultimately organized, being thus incorporated as a constituent element with the pre-existing structures. To this form of coarctation, to which the succeeding remarks will be limited, the term organic is usually applied, and, as signifying the same thing, the word permanent is occasionally employed.

Organic strictures are divided into simple and complicated, common and traumatic, partial and complete, soft and callous, dilatable and undilatable, permeable and impermeable, recent and old. These terms, which are constantly employed by writers, are sufficiently significant, and do not, therefore, require any special explanation.

Much diversity prevails in relation to the seat, number, form, consistence, and extent of organic strictures. A careful examination of these circumstances must, therefore, constitute the next subject of inquiry, for it is self-evident, that, without a well-grounded knowledge of them, our treatment must generally be conducted in a random and hap-hazard manner.

Seat.—No part of the urethra, except, perhaps, the prostatic, is entirely exempt from organic stricture. The disease, however, as might be expected, does not occur with equal frequency at all points of the tube. It would be exceedingly difficult, if not impossible, looking merely at the statements of authors, to determine where it is most commonly found, for upon no subject, connected with the urinary organs, does there exist a greater contrariety of opinion. This is

not surprising, when it is considered that every man forms his judgment according to his experience or his means of observation. The results of my practice lead me to infer that the affection is most common, first, in that portion of the urethra which is comprised between the scrotum and the head of the penis; secondly, at the membranous part of the tube, or at the junction of this and the bulbous part, and, lastly, at the anterior extremity, within a few lines of the meatus. I have never seen a stricture in the prostatic portion of the canal, and therefore conclude that it must be exceedingly rare there, if indeed it ever exists. I have repeatedly met with the disease near the external meatus.

"Every part of the urethra," says John Hunter,¹ "is not equally subject to strictures, for there appears to be one part which is much more liable to them than the whole of the urethra besides, that is, about the bulbous part. We find them, however, sometimes on this side of the bulb, but very seldom beyond it. I never saw a stricture in that part of the urethra which passes through the prostate gland." "I have not," remarks John Shaw,² of London, "in more than a hundred dissections which I have made of diseases of the urethra, seen a stricture or narrowing of the canal posterior to the ligament of the bulb; nor have I been able to find one example of stricture beyond this part among those preserved in the college museum." Scemmering³ also declares that the lesion never occurs in that part of the canal which is surrounded by the prostate. Ricord, however, has seen this portion of the urethra narrowed, independently of the prostate; and a similar case is cited by Mr. Crosse, of England.⁴

Ducamp⁵ states that five times out of six the obstruction is situated at a distance of from four and a half to five inches and a half from the external orifice of the urethra. If, he adds, greater precision be required, it may be affirmed that in four cases out of five it is to be found at four inches and three-quarters to five inches and three lines. He has sometimes discovered a stricture at the distance of four inches; in two cases it occurred at about two inches; and in two others it was situated at the very orifice of the canal.

Lallemand asserts that the statement of Ducamp is incorrect, and

¹ Complete Works, by Palmer, ii. p. 102.

² Medico-Chir. Trans. xii. p. 461.

³ *Traité des Maladies de la Vessie et de l'Urètre*, par Holland, p. 165, Paris, 1824.

⁴ Acton on Venereal Diseases, p. 101, New York, 1846.

⁵ *Treatise on Retention of Urine*, translated by Dr. Herbert, p. 12, New York, 1827.

that the greater number of strictures occur at the pubic arch, that is, about six inches from the external orifice. "The ordinary situation of a permanent stricture," says Sir B. C. Brodie,¹ "is at the membranous part of the urethra, just behind the bulb of the corpus spongiosum." According to Amussat,² the most common site is the point of union between the bulbous and muscular portions of the canal. The obstruction, he says, is also very frequently met with at the commencement of the navicular fossa, near the external opening. He has never seen it in the prostatic part of the tube. "It is at the junction," says Vidal,³ "of the membranous and bulbous portions, *rather towards the first*, that true coarctations are most frequent." Civiale⁴ affirms that the only regions in which true organic strictures are found, are, first, the external orifice; secondly, the two extremities of the navicular fossa; thirdly, the anterior part of the spongy portion; and, fourthly, the sub-pubic curve, at the union of the membranous and bulbous divisions.

M. Leroy D'Etiolles⁵ asserts that nineteen-twentieths of strictures are situated immediately behind the bulb of the urethra, at the commencement of the membranous portion. Next in point of frequency are strictures of the posterior extremity of the navicular fossa, then those of the urinary meatus, and, lastly, those of the spongy portion, at a distance of from two to two inches and a half behind the meatus. He states that the disease may occur in the prostatic division of the tube, and that he has a specimen in his private collection illustrative of the fact.

The seat of this disease has recently been very carefully examined by Mr. Henry Thompson,⁶ of London, who has availed himself of the advantages afforded by the various public collections in the British metropolis, the Dupuytren Museum of Paris, and the Museum of the Royal College of Surgeons at Edinburgh, including the collection of the late Sir Charles Bell. The number of specimens inspected was two hundred and seventy, embracing three hundred and twenty distinct strictures. Of these 215, or 67 per cent. of the entire number, were situated at the junction of the membranous and spongy portions and its vicinity, 51, or 16 per cent., in the centre of the

¹ Lectures on the Diseases of the Urinary Organs, p. 6, 8d ed. Lond. 1835.

² Lectures on Retention of Urine, translated by Dr. Jervcy, p. 15. Phila. 1840.

³ Pathologie Externe, t. v. p. 52, deux. édit. Paris, 1846.

⁴ Traité Pratique sur les Maladies des Organes Génito-Urinaires, t. i. p. 124.

⁵ Des Retrecissemens de l'Urètre, &c., pp. 82 and 88. Paris, 1845.

⁶ Pathology and Treatment of Stricture of the Urethra, p. 87. London, 1854.

spongy portion, and 54, or 17 per cent., at the external orifice, and within two inches and a half behind this point. Mr. Thompson found that the disease was nearly as frequent one inch in front of the junction of the membranous and spongy divisions as at the junction itself, and least frequent of all at the posterior part of the membranous portion. In 226 cases, the stricture was single, and, in 185 of these, it occupied the posterior region above described, in 17 the middle region, and in 24 the anterior region. In 8 cases the tube was contracted in all these regions, in 10 in the first and second only, in 10 in the first and third only, and in 13 in the second and third only. Mr. Thompson avers that there is not a solitary preparation in any of the public museums of London, Edinburgh, or Paris, in which a stricture occupies the prostatic portion of the canal.

In ninety-eight specimens of stricture, contained in the different London museums, Mr. Henry Smith¹ found that the disease was seated in the membranous portion of the urethra only in twenty-one; while in seventy-seven it was anterior to the triangular ligament, the obstruction in the majority of the latter being either in the bulbous portion, or a little in advance of it.

Number.—Strictures vary much as to their number. In a majority of the cases that have fallen under my observation, there was not more than one; frequently, however, I have seen two, and occasionally I have met with three and even four. The latter number is rare; nevertheless, it is sometimes exceeded. Thus, John Hunter saw an instance of six; Lallemand, of seven; and Colot, of eight. When the strictures are multiple, they may be in close proximity with each other, or separated by a considerable interval. A French writer, Ducamp, states that when there are several coarctations, the most extensive one will commonly be found at the curve of the urethra, and the others between this point and the head of the penis. My practice has not furnished me with any such coincidence.

Form.—The most common form of stricture is that in which the urethra exhibits the appearance as if a thread or piece of twine had been tied around it. It is not, however, as might be inferred from this remark, always circular; on the contrary, it is often oblique, and sometimes even bifurcated. It may embrace the entire circumference of the tube, or only a part of it; and varies in its antero-posterior extent from half a line, or even less, to several inches. In

¹ Ranking's Half-Yearly Abstract, No. X., July to December, 1849, p. 253. Phila. 1850.

a remarkable instance which I witnessed, many years ago, in the practice of a physician of Pennsylvania, the contraction involved nearly the whole length of the canal from one extremity to the other. The degree of coarctation ranges between the slightest diminution of the natural size to almost complete obliteration. When the disease

Fig. 155.

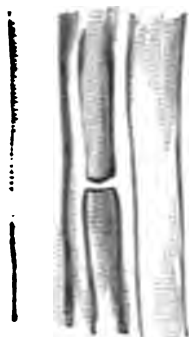
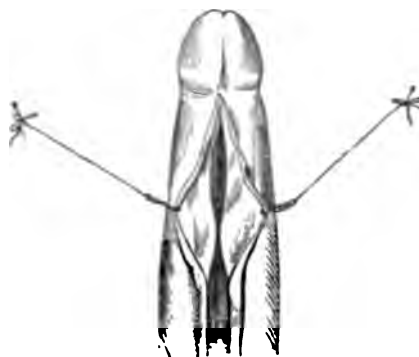


Fig. 156.



Fig. 157.



has reached this point, the urine is discharged in drops, and the bladder is seldom, if ever, entirely empty. Few strictures, however firm or narrow, can be said to be impermeable, in the true acceptance of that term.

A very rare form of the disease, called the *bridle stricture*, is occasionally met with. In this variety, which has been particularly described by Sir Charles Bell, although it had been previously noticed by others, the urethra is obstructed by a small narrow band, which is stretched across the tube from one side to the other. It is com-

posed of plastic lymph, and is usually of a tough, fibrinous consistence, being of a pale straw color, and of variable form and dimensions. Occasionally it is a narrow, thread-like band, arranged so as to divide the passage into two parts; sometimes it has the appearance of a valve, similar to that of a vein; and now and then it presents itself in the form of a fleshy excrescence, vegetation, or caruncle. Few surgeons have been so fortunate as to see this stricture, while many have denied its existence altogether. For my own part, I am not certain that I have ever met with a solitary instance of the bridle-stricture, properly so termed, although I have several times seen fleshy growths in the urethra.

Consistence.—The contracted part may be soft and elastic, or hard and firm, according to the duration of the disease, and the degree of transformation of the effused lymph, upon the presence of which the obstacle depends. Recent strictures are generally soft and yielding, on which account they are frequently described as *dilatable* strictures; old strictures, on the contrary, are usually callous, tight, and resisting. Exceptions to this rule are, of course, not uncommon. Thus, I have known a stricture acquire such a degree of firmness, in a few months, as to render it impossible to pass even the smallest sized bougie until after it had been divided with the lancetted stylet. On the contrary, I have occasionally met with an ancient stricture which readily and permanently yielded to the process of dilatation in a very few days. It is worthy of remark that the consistence of a stricture, especially if it be large, is seldom uniform, but that it varies in different parts of its extent, being, perhaps, quite soft at one point, hard at another, and fibro-cartilaginous at a third.

Color.—Organic strictures vary in their color. This is sometimes perfectly normal; but, in general, the affected part is of a grayish, light straw, or whitish aspect, forming thus a striking contrast with the rosy tint of the surrounding surface.

Impermeableness.—Are strictures of the urethra ever impermeable? Much has been said and written upon this subject, especially of late, and it is, therefore, very important that the meaning of the term should be clearly defined and accurately understood. The practical bearing of the question will appear evident as the discussion proceeds.

As long as a stricture admits of the discharge of urine, it cannot, in the true sense of the term, be considered as impermeable, although it may be impassable by the bougie, sound, or catheter. The dis-

injury is real, not imaginary, and exists, I presume, much more frequently than practitioners generally imagine. A stricture that is completely impermeable cannot, in the very nature of things, continue so beyond a short period without retention of urine, followed, if relief be not promptly afforded, by extravasation of that fluid, or by the death of the patient. But in most cases of this kind, such a result is wisely anticipated by the formation of a fistule immediately behind the seat of the obstruction. In this way an outlet is established through which the urine, either wholly or in part, afterwards escapes, and which never closes until the cause by which it has been induced has been effectually removed.

Strictures which are impermeable to urine are, I presume, very infrequent; nevertheless, they occasionally occur, and I have met with them both in the male and female, though only once in the latter. In this remarkable case, which I saw in consultation with my colleague, Professor Miller, and which has been already described, the patient, a colored woman, aged twenty-seven, had been unable to pass a drop of urine by the urethra for upwards of a whole year. She sustained some injury during her confinement, which eventuated in the formation of a vesico-vagino-rectal fistule, with total obliteration of the urethra and vagina, the whole of the urine being discharged by the anus. In the male, I have seen at least four cases, which I can now recall to my mind, of this form of coarctation. The last was that of a young gentleman, aged twenty-four, from Mississippi, who, in consequence of an obstruction thus produced, became the subject of stone in the bladder, which I removed by the lateral section. Two fistulous apertures existed just in front of the scrotum, through which every drop of urine was evacuated. The stricture was of a firm, dense, fibrous consistence, and of a whitish appearance, offering great resistance to the knife, and completely obliterating the urethra.

Very different from this form of stricture is that which is impermeable to an instrument, as a bougie or catheter. It has been asserted by some of the leading authorities in matters of this kind of the present day, that there is no such stricture; that whenever there is room enough for the passage of urine, there is space enough for the introduction of an instrument, and that when the surgeon fails to accomplish his object, his want of success is attributable rather to his own awkwardness than to the nature of the obstruction. Dr. James Syme, Professor of Clinical Surgery in the University of Edinburgh, is one of those who hold this opinion; he

maintains that there is no truly impermeable stricture, and declares that he has never met with an instance in which he was foiled in the introduction of the catheter. Mr. Liston¹ had previously expressed a similar view. Referring to the "button-hole" operation, as it is termed, he says: "It has been proposed in what are called impassable strictures; but there are no strictures impassable that I have ever seen; for, when any water comes away, you can, by patience and perseverance, get a catheter through, sooner or later." So far as I can comprehend the sentiments of these gentlemen, and of those who concur with them—a very small number, by the way—they are not to be understood as pretending to deny the existence of cases of complete obliteration of the urethra from external injury, as a blow, fall, or kick upon the perineum; their views are intended to apply only to ordinary strictures, or strictures produced by common causes.

The question as to the impermeableness of stricture, so important in a practical point of view, can be decided only by an appeal to individual experience, not by angry discussion, which is generally, in matters of this kind, as disreputable to those engaged in it as it is injurious to the true interests of science. Observation, which is everything here, must be the sole and exclusive arbiter in the case; controversy can do no good; and misrepresentation must do harm. When Mr. Syme, concerning whose views upon this subject so much has of late been said and written, and that, too, in no very smooth and measured tone, declares that he has never met with an impermeable stricture, are we not obliged, by all the rules of courtesy and good-breeding, to believe him? We have no right to doubt his word, or to impugn his motives. His position as a teacher and author, his age, his experience, and his acknowledged skill as an operator, all pre-eminently entitle him to this consideration. To discredit the statements of such a man is to cast an imputation upon the whole fraternity. The question is one, I repeat it, solely of individual experience, of individual skill. It cannot be denied that one man is more adroit in the exercise of his profession than another. We often see proofs of this in the most simple, as well as in the most difficult operations. The introduction of the catheter affords a familiar illustration. It is no vain boasting when I declare that I have frequently succeeded with it after others had signally failed. Now, the same thing is true in regard to stricture. Cases continu-

¹ London Lancet, Feb. 20, 1836.

ally arise where one surgeon is completely foiled in his endeavors to pass an instrument, in which another, perhaps a little more dexterous, patient, and experienced, readily succeeds. Skill, like knowledge, is relative. It is not possessed in an equal degree by all practitioners. Those who enjoy it in the greatest perfection often perform exploits which, to ordinary men, appear insurmountable. If Mr. Syme can do what no one else has done, is it hence to be inferred that he asserts what is not true? Such a conclusion, to say the least, would not be very philosophical. Let us rather conclude that surgery, like the army, has its generals, and that God has not endowed all practitioners of the healing art with the same mental capacity and manual dexterity.

It is reported of the late Mr. Liston that he had practised surgery for upwards of a quarter of a century, before he became convinced of his fallibility in regard to the introduction of the bougie and catheter. Prior to this period he was, as already stated, often heard to declare that there was no impassable stricture. But we have the authority of Mr. Cadge, who assisted him in most of his operations for a considerable period before his death, for saying that he was repeatedly foiled in the use of these instruments even in ordinary stricture; and Mr. Lizars,¹ of Edinburgh, asserts that, during a visit which he made to the North London Hospital, he saw "the cold sweat start in big drops from his forehead" in his efforts, long and arduously continued, to relieve a man of retention of urine dependent upon that cause. Now, what occurred to Mr. Liston may happen to Mr. Syme. This gentleman is still engaged in the active duties of his profession, and it is not difficult to conceive that he too may be foiled in his efforts to carry a catheter through a stricture.

But the fact that this form of stricture is ignored by certain pathologists, by no means proves that it does not exist. Who does not know that in cases of long standing, or in those in which there has been much effusion, the urethra often assumes a zigzag direction; or, at all events, that it deviates in a very remarkable, and, as it respects the passage of an instrument, in a most embarrassing, degree from its normal course; that the perineum is sometimes converted into a hard, callous, and riddled mass; and that, finally, there is occasionally a multiplicity of coarctations, changing, in the most serious manner, the natural relations of the tube? All these circumstances may, without any stretch of the imagination,

¹ Practical Observations on the treatment of Stricture of the Urethra and Fistula in Perineo, p. 20. Edinb. 1851.

be supposed to offer so many insurmountable obstacles to the passage of an instrument, one even of the smallest size, and in the hands of the most adroit and accomplished operator; all this, I say, may be assumed; but I go farther, and assert, upon the testimony of personal experience, the best test of all, that there is a class of strictures, the result of ordinary causes, which, while they admit of the passage of the urine, slowly and imperfectly it may be, do not permit the introduction of any instrument, however small, into the bladder.

Symptoms.—The symptoms of stricture, considered generally, are diminution of the stream of urine, which is usually spiral, forked, or dribbling; frequent, slow, and difficult micturition, often preceded, accompanied, or followed by a sense of scalding; a discharge of thin, gleety matter from the urethra; uneasiness about the loins, perineum, and anus; pain in coition; nocturnal emissions; elongation and thickening of the penis; and hardness at the seat of the obstruction, detectable by the finger. During the progress of the disease, the patient is liable to be troubled with swelling of the testicle, chordee, hemorrhoids, hernia, and retention or incontinence of urine. The general health is variously affected; sometimes slightly, at other times severely. In the more aggravated forms of the malady, there is almost always derangement of the digestive organs; the system is more or less irritable; and the slightest exposure, fatigue, intemperance, or irregularity in eating, is apt to be followed by an exacerbation of the local suffering. Let us examine these symptoms a little in detail.

One of the first circumstances which generally attract the attention of the patient, and lead him to suspect that something wrong is going on in his urinary organs, is a slight diminution of the stream of urine, accompanied by a sense of scalding in the urethra, a feeling of weight at the neck of the bladder, and an increased frequency of micturition. He is, perhaps, obliged to use the chamber several times during the night; and, if he is exposed to cold, takes much exercise, or indulges a little more than usual in the pleasures of the table, he finds that he is unable to retain his water as well as formerly, or that it passes only drop by drop, and with considerable pain and spasm. By and by, the local symptoms assume a more decisive character. The stream of urine is much smaller than it was at first, and has a wiry, twisted, spiral, or corkscrew shape: sometimes it is double, forked, or bifurcated. Its force is also sensibly lessened; instead of being projected in an arched form, as it is in the natural state, to a distance, perhaps, of several yards, it falls

perpendicularly between the patient's feet, or upon his trousers, although he is conscious that the bladder at the time is making unusual efforts to expel its contents. In the worst forms of the disease, the urine is discharged in drops, or it dribbles away from the penis, and flows noiselessly into the receiver. This mode of micturition may be constant or intermittent, and is often, from the most trifling cause, followed by complete retention.

A prominent symptom of stricture is frequent, slow, and difficult *micturition*. In the healthy state, the moment the bladder contracts, its contents begin to flow, nor do they cease until they are completely evacuated. In stricture, on the contrary, great difficulty is often experienced in starting the urine, and an unusual length of time is required to effect its discharge, accompanied by much straining, and pulling of the penis. In fact, the affected part is obliged to undergo a sort of preliminary dilatation, which, as well as the subsequent steps of the process, demands the full play and co-operation of the diaphragm and the abdominal muscles. Straining, sometimes violent and long continued, is seldom entirely absent in this disease. To promote the flow of urine, the patient throws his body forwards, and squeezes with all his might, as if he were about to force out both the bladder and bowels.

In nearly all cases there is *morbid sensibility* of the urethra, or of the urethra and the neck of the bladder. The affection is evidently seated in the mucous lining of the part, and often constitutes a source of real suffering. Considerable diversity obtains in regard to the nature and amount of this morbid sensibility. Most commonly it is a scalding or burning; but sometimes it is merely a feeling of soreness, uneasiness, or tickling. It may be circumscribed or diffused; slight or severe; intermittent or persistent. The most trifling circumstance, such as an acrid state of the urine, an attack of rheumatism, exposure to cold, or the use of stimulating food or drink, is liable to increase it.

Another effect of stricture is a discharge from the urethra, denominated *gleet*, or, as it is called by the French, a sweating of the penis. This symptom is of frequent occurrence, and is, in fact, sometimes the only one present; still it is not characteristic. The matter, which is mucous, serous, or muco-purulent, is more or less opaque, thin, and viscid, and varies in quantity from a few drops to half a drachm or more in the twenty-four hours. It is usually most abundant in the morning, before micturition; stains the patient's linen, and agglutinates the lips of the orifice of the urethra. The

discharge has sometimes a thready appearance, like vermicelli; and not unfrequently it occurs in the form of little flakes, of a whitish or yellowish color, similar to particles of soft-boiled rice. The secretion, in whatever aspect it exhibits itself, proceeds from the mucous membrane of the urethra, which, in most cases of stricture, is in a state of inflammation, both behind and in front of the site of the obstruction. It is sometimes absent for days together, and then, in consequence of increased local irritation, returns as copiously as ever. Trifling as this symptom apparently is, it always proves a source of great annoyance to the patient, who looks for it fifty times a day, and is sure, when he finds it, to post off to consult his physician about it.

Patients affected with stricture suffer much with pain and tenderness in the *perineum*, anus, and penis. Very frequently, the irritation, which is always purely sympathetic, extends to the groin, the sacro-lumbar region, and the testes, the latter of which are occasionally so exquisitely sensitive as to be unable to bear the slightest pressure, or even the touch of the finger. The bladder also is often the seat of considerable pain, of a scalding or burning character, and chiefly referable to the neck of the organ, though sometimes it is diffused over the entire viscus, and is much increased by pressure upon the hypogastrium, rough exercise, sexual intercourse, and other causes. A most distressing symptom, occasionally witnessed in this complaint, is a constant irritation in the superior part of the rectum. It is most apt to manifest itself when the disease extends its ravages to the prostate gland and the cellular substance between the bladder and the bowel.

Nocturnal *emissions* are very prone to occur in stricture, especially in that variety which is attended with an unusual amount of morbid sensibility of the urethra and neck of the bladder. They generally take place under the influence of a lascivious dream, and are almost always accompanied by imperfect erections and considerable pain. The semen, at such times, as well as in the act of coition, instead of being ejaculated, passes backwards into the bladder, or is retained in the urethra, behind the obstruction, from which it afterwards oozes out by degrees, or is discharged, along with the urine, in a state of solution. It is for this reason that a man, affected with a tight, callous stricture, is sometimes impotent; for, although he may be able to copulate, he cannot procreate, because none of the secretion reaches its destination, except, perhaps, when the act is unduly protracted.

The *penis*, in stricture, undergoes a sort of hypertrophy; it is longer and thicker than usual, more or less deformed, and deprived, at least in some degree, of its natural sensibility. The prepuce, which generally participates in the enlargement, is sometimes so much infiltrated with serosity as to require to be punctured, in order to prevent gangrene. These appearances are caused by the constant pressure and pulling which the patient is obliged to exert to facilitate the process of micturition.

There is often a good deal of hardness of the urethra, not in its entire extent, but at some particular point. The parts most commonly implicated, according to my observation, are the bulbous and membranous, where the deposit of lymph, the immediate cause of this symptom, is sometimes so considerable as to compress the tube, or throw it out of its natural course, thus greatly increasing the difficulty of introducing a catheter or bougie. The induration, which is always produced by an extension of the inflammation of the mucous membrane of the urethra to the subjacent tissues, is generally easily detected by the application of the finger, and should not be confounded with that which is caused by the stricture itself.

Chordee is frequently a troublesome symptom in this disease. Although most common at night, it sometimes comes on in the day, and always proves a source of much annoyance, if not of actual suffering. When the cells of the spongy structure of the urethra are distended with lymph, the penis in erection may be drawn downwards, upwards, or laterally, according to the situation of the effusion, upon the presence of which the incurvation depends.

Another symptom, which is occasionally noticed in this affection, is *hæmaturia*, or a discharge of blood from the urethra. The hæmorrhage is usually slight, and seems to be most common in old, callous strictures, attended with dilatation of the canal, and varicosity of the lining membrane. The occurrence is most frequent during erections, and probably always depends upon a laceration of some of the larger vessels of the affected part, which are unduly stretched when the penis is in this condition. A considerable hæmorrhage is also sometimes excited during the passage of a bougie or catheter, no matter how gently this may be effected.

During the progress of the disease, the patient, in consequence of the constant straining to which he is subjected whenever he attempts to void his urine, is liable to suffer from hemorrhoids, prolapse of the bowel, and even hernia. These complications, which are sufficiently common, especially in elderly persons, greatly increase

the local distress, and assist materially in undermining the general health.

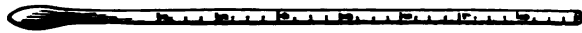
The *urine* is variously altered in stricture, according to the degree of irritation of the urinary bladder, the prostate gland, the ureters, and the kidneys. When these organs participate in the mischief, as they are apt to do, sooner or later, they throw off an unusual amount of mucus, which, mingling with the urine, imparts to it a remarkably viscid, ropy character, changes its color, and induces new chemical affinities. The fluid, which is generally loaded with saline matter, is speedily decomposed on exposure to the atmosphere, and, in fact, often even in the bladder, emits an ammoniacal odor, and is of a whitish, lactescent, dark, or blackish tint.

Finally; as two other effects of stricture, I may mention here *retention* and *incontinence* of urine. As these affections, however, have been already fully described, I will merely add that the first is the most common in the milder forms of the malady, and the last in the more severe. It should not, however, be forgotten that the constant dribbling, witnessed under such circumstances, is usually an evidence of retention rather than of incontinence; the distinction is of great practical consequence, and a correct diagnosis is therefore of paramount importance. When the urine passes off incessantly, the attendant may rest assured that, as a general rule, the bladder is never entirely empty, but that a certain quantity of water remains in its more dependent portion, where it soon becomes a source of irritation and suffering.

Diagnosis—Physical Exploration.—Although the symptoms which have now been considered are, in general, sufficiently denotive of the real nature of the disease which produces them, they can, nevertheless, not be regarded as pathognomonic. They may be the result of other causes, and are, therefore, rather of negative than positive value. To establish, in an unequivocal manner, the diagnosis in any given case, it is indispensably necessary to explore the urethra with some instrument. The one which I usually select for this purpose, is a common silver catheter, of moderate size, and a little conical at the extremity, which is passed down the tube, first to the obstruction, then into it, and lastly, if possible, beyond it. In this manner we may easily obtain an idea of the seat and extent of the stricture, as well as of its consistence. Where greater accuracy is required, I use a wax bougie, which is carried slowly down to the obstruction, upon reaching which the penis is pulled slightly forward, over it, and a mark made upon it with the thumb-nail imme-

diately in front of the head of the organ. This will indicate the precise distance of the stricture from the external orifice of the urethra.

Fig. 158.



Instead of this instrument, a graduated bougie (Fig. 158), the end of which is tipped with cobbler's wax, may be used. To ascertain the extent and existence of the obstruction, all that is necessary is to insinuate the point of the bougie into the affected part, and to retain it there for a few minutes, until it has become moulded to its place. Thus an exact impression of the stricture is obtained, which may afterwards, as has been alleged by some of the French surgeons, as Dupuy and Civiale, be turned to great account in the treatment. For my own part, I must confess I think such an examination of little consequence, in any way, and hence I seldom resort to it. For all practical purposes, the ordinary mode, above described, answers every object for which such a procedure is instituted. When there is a plurality of strictures, the fact cannot always be determined until the most anterior one has been removed.

All examinations of this kind should be conducted with the utmost gentleness and deliberation. All rough and hasty proceedings are calculated to do harm by exciting spasm and irritation, and should, therefore, be carefully avoided. By slow and cautious manipulations, the point of an instrument may often be insinuated into the tightest stricture, or into one so tender and irritable as to resent every attempt of an opposite description.

A tolerably correct idea of the nature, seat, and extent of a stricture may sometimes be acquired by the application of the thumb and finger along the under surface of the penis. The part corresponding to the obstruction is not only indurated but contracted, and in such a case it is almost as easy to determine the character of the affection by an external examination as by the use of the catheter or bougie. These remarks are, of course, chiefly applicable to strictures of the spongy portion of the canal; for, when the disease is situated far back, a more accurate and thorough exploration alone will suffice.

Dr. Henry J. Bigelow,¹ Professor of Surgery in Harvard Univer-

¹ Boston Med. and Surg. Journ., Feb. 7, 1849.

aity, has recently called the attention of the profession of this country to the use of gutta percha for taking impressions of stricture. He has performed numerous experiments with it, and thinks it far superior for this purpose to wax, so commonly trusted to. His method of employing it is to take a medium-sized bougie of this kind, well oiled, and to pass the tip rapidly to and fro in the edge of the flame of a candle until it is so warm as to be indented by the nail; the mass will remain plastic after the surface has ceased to be hot, and may be quickly carried down to the stricture, being very smooth and pliable. If it be pressed against the obstruction for a minute with a force equivalent to the weight of one or two ounces, and then left in the part triple this space of time to cool, it will present, when slowly and carefully disengaged from the stricture, a firm, unyielding, and most accurate impression of the inequalities of the callous surface. "The tip," observes Dr. Bigelow, "may be cut off, and preserved, furnishing, with others, a complete history of the conformation of the stricture under treatment." The gutta percha used for this purpose should be perfectly pure; and no warm water should be employed in preparing it, as the steam given off by it has a tendency to soften the bougie for several inches, and render it liable to curl up against the stricture, like a small elastic bougie.

I have little experience with this mode of taking impressions of strictures; but from the fact that it comes so highly recommended by so clever a surgeon as Dr. Bigelow, I should think it deserving of the favorable consideration of the profession. It seems to me to be particularly valuable in bifurcated strictures, or strictures attended with the formation of false routes, inasmuch as the smallest point can be easily insinuated into the narrowest passage, and thus indicate which is the natural and which the abnormal one.

Pathological Effects of Stricture.—Stricture seldom exists long without giving rise to disease in the adjoining and associated parts. The organs, besides the urethra, which are most liable to suffer are the prostate gland, the bladder, the ureters, and the kidneys. The testes, penis, seminal vesicles, perineum, anus and rectum, also not unfrequently participate in the evils consequent upon the malady. The affections which thus spring up during the progress of the mechanical obstacle of the urethra, are often of a most serious character, and add greatly to the distress and danger of the case.

One of the most frequent as well as the most serious, lesions consequent upon stricture, is a *dilatation* of the urethra behind the seat of the obstruction

Fig. 159.



(Fig. 159). This is evidently owing to the manner in which the urine is impelled against the stricture whenever an attempt is made to evacuate it; and varies in degree from the slightest increase of the natural caliber of the tube to that of a pouch, capable of holding an almond or a pullet's egg. In the more aggravated forms of the affection, the abnormal reservoir presents the appearance, and subserves the purpose, of an accessory bladder, which is habitually distended with urine. The parietes of the dilated part are generally attenuated, and therefore liable to give way under the pressure of

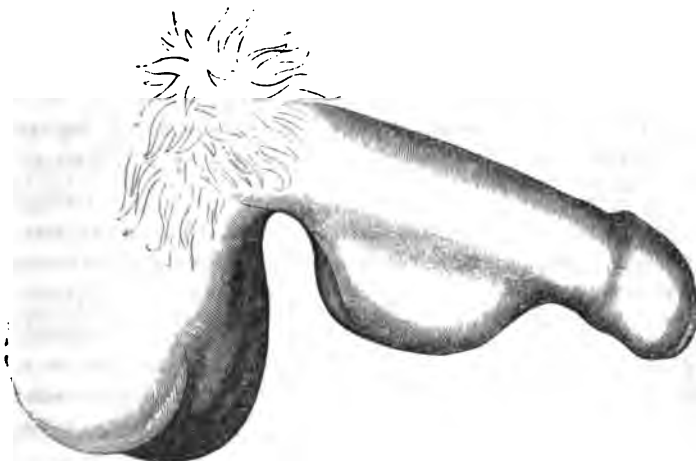
its contents. The enlargement is most common at the membranous and prostatic portions of the urethra, but may take place at any point of its extent. Sometimes it involves nearly the whole length of the canal, and is so great as to admit a middle-sized finger.

The urethra in front of the obstruction is either normal, diminished, or dilated. The latter occurrence, of which Sir Charles Bell has related and figured a most extraordinary example, is exceedingly rare, and cannot be satisfactorily accounted for upon any known pathological principles. In cases of long standing, and especially in those which are accompanied by fistule of the perineum, allowing most of the urine to escape in that direction, this portion of the canal is sometimes considerably diminished, but seldom entirely obliterated. In the milder forms of the malady, the tube in front of the stricture is generally natural.

CASE I.—In a patient, aged twenty-two, whom I attended for stricture of the urethra in the autumn of 1851, a remarkable tumor existed on the under surface of the penis, giving this organ a most singular and grotesque appearance, sketched in Fig. 160. Of a semi-ovoidal shape, it was of solid but elastic consistence, and was six inches and a half in circumference, by three inches and a half in length. It had been first noticed about three months previously, from which time it had gradually increased until it had acquired its present bulk. It was entirely free from pain, but had disqualified the young man for sexual intercourse, and was a source of great disquietude to him on account of the obscurity of its character. On cutting into it, it was found to contain an ounce of clear, limpid water, and to be nothing but a urinary cyst, the inner surface of which was perfectly smooth and glossy. At the inferior part of the tumor, near its centre, was a small fistulous opening, giving vent fre-

quently to a little urine, and always, when the part was compressed, to a small quantity of muco-purulent fluid. The urethra contained two very tight strictures, of two

Fig. 160.

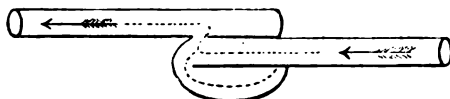


years' standing, and the product of a violent attack of gonorrhœa; one was situated just behind the external orifice, and was so small as hardly to admit a stout bristle; the other was three inches further back, and also very firm and callous. It was over the last stricture that the cyst here described was situated; it was entirely on the outside of the canal, and had evidently been caused by a rupture of the mucous membrane, followed by the escape of urine, and the gradual expansion of the surrounding cellular tissue. The skin was entirely free from discoloration, but was a good deal thickened by interstitial deposits.

An instance of a somewhat similar character, dependent, however, upon external injury, and a want of parallelism between the ruptured ends of the urethra, occurred to my friend, Dr. Washington L. Atlee, of Philadelphia, and is related in the *American Journal of the Medical Sciences* for October, 1849.

CASE II.—A mulatto, aged twenty-five years, received a severe injury in the perineum by the fall of his horse, which was succeeded by a constant dribbling of urine, and the formation of a tumor at the base of the scrotum, along the track of the ure-

Fig. 161.



thra, of an elastic character, and about the size of an almond, diminishing under pressure, and enlarging during every effort at micturition. A catheter could be

easily passed as far as the posterior part of the tumor, but here it was abruptly arrested, and refused to proceed any further. Subsequently, upon dividing the tumor, it was ascertained that the extremities of the urethra overlapped each other, the lower one terminating in a *cul-de-sac*, while the upper one had become closed by its adhesion with the surrounding structures. The relative position of the parts is accurately represented by the annexed cut (Fig. 161). The course of the urine is indicated by the dotted lines and arrow-heads. It is proper to add that the operation performed by Dr. Atlee was entirely successful.

CASE III.—In a case observed by Mr. Joseph Elze,¹ Surgeon to St. Thomas's Hospital, London, a tumor of this kind contained not less than ninety-three calculi, of various forms and sizes, the largest weighing twenty-six grains, the smallest a grain and a half. They all had smooth surfaces, as if they had rubbed against each other. The patient, aged thirteen years, had suffered from vesical disease from his infancy; and the tumor, which was hard and exquisitely tender, was situated on the right side of the scrotum, its volume being liable to temporary enlargement from the ingress and retention of urine. He had occasionally, for several years, voided concretions similar to those already mentioned, and had often been obliged, in consequence of obstruction in the urethra, to employ the catheter. The bag, which was removed by Mr. Elze, was a quarter of an inch thick, very rough internally, and exceedingly sensitive. The wound gradually healed, all to a small aperture, through which a little urine continued to flow during micturition.

There are few cases of organic stricture in which there is not more or less inflammation of the *mucous membrane* at, and for some distance beyond, the seat of the obstruction. The greatest amount usually exists behind the stricture, but there is not unfrequently a good deal within it, as well as in front of it. The disease is indicated by increased vascularity, and sometimes, also, by a deposition of lymph. Occasionally the mucous membrane is ulcerated, or studded with soft warty excrescences.

Another consequence of stricture is the development of *fistule* in the perineum, caused by ulceration or rupture of the mucous membrane behind the seat of the obstruction, and the escape of a small quantity of urine into the subjacent tissues; or by the existence of irritation exterior to the canal, and its gradual extension to its interior. In either case, an abscess, or, what is worse, a slough, is formed, followed by a fistule, through which more or less of the urine continues to be discharged until the stricture upon which it depends is removed.

A peculiar *cellulated* appearance of the urethra is sometimes observed as a result of this disease. It consists of a number of little cavities, pouches, or depressions, of an oval form, and confined

¹ The Works of the late Joseph Elze, F. R. S., by George Vaux, p. 119; London, 1782.

chiefly to the lower surface and sides of the tube. They are covered by a smooth, glossy membrane, and are always most common in the posterior portion of the urethra. It has been supposed that these cells are formed by a rupture of the mucous lining; but it is more probable that they are caused merely by its excessive attenuation, and a partial separation of the subjacent tissues.

It was formerly supposed that enlargement of the *prostate* was a very common effect of organic stricture of the urethra. Recent and more accurate observation, however, has fully disproved the truth of this opinion, and shown that when these two affections coexist, the circumstance is generally to be regarded as purely accidental. Although enlargement is infrequent, this gland unfortunately often suffers in other respects. The most common lesion, in tight, callous, and protracted stricture, is inflammation of the substance of the organ, eventuating occasionally in suppuration, the development of an abscess, the formation of calculous concretions, complete atrophy, or the degeneration of the gland into a membranous pouch. From extension of the irritation, an abscess sometimes forms between the bladder and the rectum, causing excessive suffering, and ultimately, perhaps, a fistulous communication.

Another effect, and that by no means an infrequent one, especially in tight and long-continued stricture, is a dilatation of the excretory ducts of the prostate. These canals are, as is well known, exceedingly diminutive in the natural state, but under the influence of the protracted irritation of the disease under consideration, they sometimes become so much enlarged as readily to intercept the point of a full-sized bougie. When such a lesion is suspected, care should be taken to raise the beak of the instrument as it glides over the prostatic portion of the urethra, otherwise the accident in question might very easily occur, and a false passage be the result.

The *bladder*, in confirmed cases, soon becomes hypertrophied, and finally sacculated. So common, indeed, is this coincidence, that it must always be viewed in the light of cause and effect. The nature of these two affections has been fully described elsewhere, and I shall, therefore, merely add here that they are generally the cause of the mucous discharges, which, in many cases, form so striking a feature of urethral stricture. Another occurrence, worthy of passing notice in this place, is the proneness, in patients affected with this malady, to the development of urinary calculi. This subject, like that of hypertrophy of the bladder, has been already fully discussed, in its appropriate place.

The *ureters* frequently participate in the disorders which arise in the progress of organic stricture. The most common lesion is inflammation of their lining membrane, with suppuration and deposits of lymph, and irregular dilatation of their caliber. Their parietes are sometimes considerably thickened, or thickened at some points and attenuated at others; and occasionally they exhibit a strictured, nodose, or puckered appearance. Cases occur in which one of these tubes is sometimes very much contracted, or nearly obliterated.

The *kidneys* are variously affected in this disease. Inflammation frequently occurs at an early period, and gradually progresses until

it ends in serious mischief, if not in total ruin of the affected organ. The malady seldom exists in the same degree in both viscera. Sometimes one is entirely healthy, or nearly so, while the other is converted into a large abscess, filled with serous cysts, inflamed, hypertrophied, granulated, or changed into a membranous pouch, devoid of renal tissue.

The adjoining sketch (Fig. 162) strikingly illustrates the effects of stricture of the urethra upon the rest of the urinary organs. The prostate gland is completely destroyed, the mucous membrane of the bladder is removed by ulceration, the ureter is immensely enlarged, and the kidney is converted into a mere shell, which was filled at the time of the dissection with purulent matter. The drawing is from a specimen in the pathological collection of the New York Hospital.

The *testes* are prone to suffer in stricture, apparently from continuous sympathy, or, more properly speaking, from direct irritation. In

many cases they become morbidly sensitive; and it is not uncommon for one or both to be swollen and indurated. The irritation occasionally extends to the vaginal tunic, and produces hydrocele.

Fig. 162.



The spermatic cords are sometimes remarkably tender, or enlarged and unnaturally hard.

The *seminal vesicles* are also liable to suffer; their lining membrane becomes inflamed, and, in cases of long standing, their volume is occasionally remarkably diminished, at the same time that their coats are very firm, dense, and contracted.

One of the most singular occurrences in old and severe strictures of the urethra is an inordinate development of the *penis*. The whole organ is not only elongated but remarkably thick, hard and rigid; a circumstance which appears to be owing, not so much to the irritation of the neck of the bladder, which often exists in a high degree in this disease, as to the milking efforts, if I may so express myself, which the patient is constantly obliged to make in order to promote the flow of urine through the obstructed urethra. For the same reason, the prepuce is often remarkably swollen and cedematous.

Causes of Stricture.—The causes of stricture may be conveniently arranged under two great heads, the traumatic and the inflammatory. Of these, the latter are by far the more common. Tumors and fleshy excrescences of the urethra, and a varicose state of the mucous membrane of this canal, cannot give rise to stricture, properly so termed, and should, therefore, be excluded from the list of exciting causes.

Violence inflicted upon the urethra, whether from without or within, may excite irritation, and develop a stricture. A wound, penetrating the tube, may fail to unite evenly, and so induce the disease. Some of the very worst and most unmanageable cases that I have ever seen were thus produced. The particular kind of injury is generally a blow, fall, or kick upon the perineum, eventuating in a laceration of the lining membrane, or of this membrane and the subjacent tissues. Sailors not unfrequently suffer in this way, by being precipitated from the rigging of a vessel; and I have seen several instances in which the accident was produced by persons falling from a considerable height upon the post of a chair. A bad stricture occasionally results from violence inflicted by a catheter or bougie. The cicatrice left after lithotomy, especially when the operation has been followed by severe inflammation, and a calculus permanently lodged in the membranous portion of the urethra, have sometimes been succeeded by obstinate contraction.

Of the inflammatory causes of stricture, the most frequent, unquestionably, is gonorrhœa, though it is not, as has been asserted by some, the only one. Whenever this disease is obstinate and pro-

tracted, or attended with much irritation, it is almost certain to be followed by a considerable effusion of lymph, and more or less contraction of the urethra. It has been supposed that stimulating injections, employed too early in this disease, are capable of producing the affection; this is undoubtedly true, but I am satisfied that the occurrence is much less frequent than is generally imagined. The point is one of practical, and not of mere theoretical importance, inasmuch as it establishes the fact that the disease is much more at fault than the remedies employed for its cure. In a word, it shows how mischievous a gonorrhoea may be, and how diligent the physician should be in his endeavors to remove it.

Protracted erections, or frequent and prolonged intercourse, have also been regarded as a cause of stricture, with what truth remains to be proved. I will not deny that the disease may be produced in this way; but there is certainly no evidence whatever that it is a common effect.

Finally; stricture is occasionally produced by chancre of the urethra. Of this I have witnessed several very obstinate cases; and of the fact mention is made by every writer upon the two diseases. The obstruction, when thus induced, is generally situated at the anterior extremity of the urethra, just behind the external orifice.

Prognosis.—Stricture, if taken in hand before it has become hard and firm, or while it is still recent, and before it has given rise to any serious lesion of the urinary apparatus, is, in general, neither dangerous, nor difficult of cure. It is, in fact, under such circumstances, rather an inconvenience than a disease. When, however, it has made considerable progress, offers much resistance to the passage of the urine, and has excited inflammation in the neighboring organs, it may be considered as a very serious affection, liable, if permitted to proceed, to be followed by the worst consequences, as may be gathered from the account which has just been given of its pathological effects. As a general rule, it may be stated that a recent stricture is much more easy of cure than an old one; a small than a large one; a soft than a callous one; an inflammatory than a traumatic one. Furthermore, a stricture of the membranous portion of the urethra is usually harder to manage than one of the spongy, chiefly because the former, in consequence of its depth and the parts by which it is embraced, is less under our control than the latter, which is comparatively accessible. An obstruction in this situation is also more liable, as a general principle, to awaken serious disease of the prostate gland, the urinary bladder, the ureters, and the kidneys.

When a stricture is obstinate and protracted, it may gradually so far undermine the general health as to cause death; or life may be assailed by the supervention of retention of urine, or by the extravasation of this fluid into the perineum or scrotum, in consequence of a laceration of the urethra. The immediate cause of death is sometimes a small calculus plugging up the canal behind the stricture, and so preventing the discharge of the urine. When the health is much impaired from protracted vesical or renal complications, the brain sometimes sympathizes in the general disorder; a slow, subacute inflammation, attended by coma, is set up in this organ and in the arachnoid membrane; and the patient at length dies from serous effusion.

Treatment.—Various methods have been employed for effecting the permanent cure of stricture. Of these the most important, and consequently the most worthy of notice, are dilatation, compression, cauterization, incision, and external division, each of which has been more or less modified, according to the wants, whims, or caprices of different practitioners. It must be obvious, at a glance, that these methods, so opposite in their character and design, are not equally adapted to all forms of the disease which they are intended to remedy. Hence, also, it will be perceived that there is a necessity, not only for describing these procedures, considered as so many distinct operations, but also for pointing out the cases to which each in particular is applicable.

Before resorting to any of these expedients, it is of paramount importance, I conceive, to attend to the general health, and to subdue local inflammation. Unless this be done, the practitioner will be much more likely to do harm than good. To effect this object, the patient should be kept in the recumbent posture for six or eight days previously to the intended operation; the bowels should be freely moved every forty-eight hours with some mild purgative; the secretions should be duly regulated; the diet should be light and unirritant; and recourse should be had occasionally to the warm bath. If there be any inflammation, irritation, or spasm of the urethra and the bladder, leeches must be applied to the perineum, followed by fomentations and anodyne enemata. Demulcent drinks should also be used; and there are few cases which will not be benefited by the exhibition of bicarbonate of soda and balsam of copaiba. Too much stress cannot be placed upon this preliminary treatment; indeed, I should consider it highly culpable to neglect it under any circumstances. When the way has been thus paved, the particular kind of treatment is to be determined by a careful

consideration of the nature of the obstruction. There are few points in surgery which require more judgment and experience than this.

Some practitioners are in the habit, in their attempts to cure organic stricture, of relying mainly upon constitutional means, especially rigid abstinence, carried almost to starvation, and the daily use of nauseating doses of tartarized antimony, or the frequent exhibition of emetics; conjoined with rest in the recumbent posture, and the avoidance of all sources of bodily excitement. That such a mode of treatment is well calculated to allay vascular action, and promote the absorption of the effused lymph which gives rise to the obstruction, may be readily imagined; but any advantages thus accruing are generally more than counterbalanced by the hardships which attend it. In the callous form of the disease, such a proceeding must be perfectly futile; for there are few cases which can receive any permanent benefit from it, and in which it will not be more likely to wear out the patient than his stricture. Of a considerable number of persons whom I have known to be treated upon this principle, I do not recollect a single one who experienced any decisive or permanent relief, or who was willing again to submit to its exorbitant, unscientific, and injurious exactions.

1. *Dilatation*.—This process was applied to the cure of stricture at an early period of the profession, and was for a long time the only one in use. Notwithstanding the various attempts that have been made to supersede it, and the reproaches that have been cast upon it by different writers, it still maintains its place in the estimation of enlightened practitioners, and there can be no doubt that it is more frequently applicable than any other plan that has yet been devised.

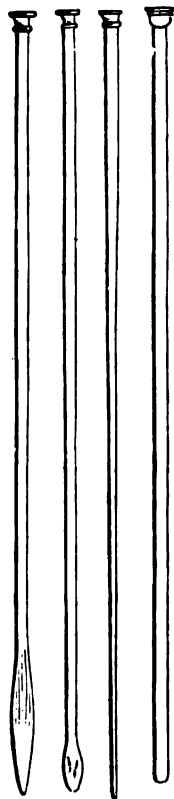
Various instruments have been recommended for this operation. The most common are bougies, made of different materials, shapes, and sizes. The earliest instruments of this kind of which we have any knowledge were composed of lead, or some other metal, which was succeeded in the sixteenth century by wax, and subsequently by gum-elastic, so much in vogue at the present day. In recent times, bougies constructed of whalebone, catgut, and flexible ivory, have been recommended, and frequently employed with advantage. My friend, the late Dr. William A. McDowell, formerly of Louisville, published, some years ago, a paper on strictures, in which he speaks very favorably of the slippery-elm bougie, having employed it successfully, as he informs us, in quite a number of instances. The fact is, almost any substance, provided it is not too brittle, and admits of a good polish, may be used for the purpose. Some sur-

geons, amongst others, Arnott, of London, and Perrève, of Paris have invented special dilators for the treatment of this affection.

Bougies are straight or curved, solid or hollow, cylindrical or conical, flexible, or inflexible, according to the choice of the operator, or the exigencies of each particular case of stricture. When the obstruction is situated very deeply, a curved instrument is generally preferred, because it corresponds more accurately with the form of the canal along which it has to pass, whereas a straight one usually answers very well when the obstacle occurs in the spongy portion of the urethra. A firm, solid bougie is usually more easy of introduction than a soft, hollow one; but the latter possesses the important advantage, when it is desired to retain an instrument permanently in the tube, of conducting off the urine, and thus obviating the necessity of a frequent change. The vesical extremity of a bougie may be cylindrical, conical, olive-shaped, or fusiform, as in the annexed cuts. Much importance has been ascribed to this circumstance, and yet, strange to say, nothing definite has been agreed upon. If there be any preponderance of weight, it is, perhaps, in favor of the conical shape, as this is generally most in accordance with the form of the stricture which the instrument has to penetrate. The length of a bougie varies from a few inches to that of the ordinary catheter. When the obstruction is situated at the anterior part of the tube, a short instrument is commonly more convenient and manageable than a long one.

My conviction, founded upon ample experience, is, that the very best instrument for dilating a stricture, is the common silver catheter, with a slightly conical point. I have now employed this instrument in the treatment of this affection for upwards of twenty years, and nothing could induce me to abandon it. It possesses all the requisites that such an instrument ought to have, namely, lightness, firmness, and durability, and is incomparably superior, in every respect, to all the metallic, wax, gum-elastic, ivory, and other bougies that have ever been invented. In making this statement, I do not wish to be un-

Fig. 163. Fig. 164. Fig. 165. Fig. 166.



derstood as saying that bougies are entirely worthless, or that they ought never to be used. If I were to do this, I should certainly do injustice to my judgment, and assert what is contrary to the experience of some of the ablest and most enlightened surgeons of the age, both in this country and in Europe. My desire is merely to recommend, in strong and decided terms, an instrument which is capable, as a general rule, of fulfilling every indication presented in this disease, even in its worst forms, and which, I am satisfied, is much less appreciated than it deserves to be.

Independently of other considerations, a very strong reason for preferring a silver catheter to every other contrivance for dilating strictures, is the fact that it is often necessary to retain the instrument in the bladder, both for the purpose of facilitating the cure and drawing off the urine. In this respect it is far superior to the gum-elastic catheter, which is not only, in many cases, exceedingly difficult of introduction, but is soon injured, if not entirely spoiled, by the contact of the acrid water. The silver instrument, on the contrary, can be retained without detriment a number of days, and possesses the additional advantage of not incommoding by its weight.

In performing the operation, the same rules are to be observed, as it respects the position of the patient, the situation of the surgeon, and the warming and oiling of the instrument, as in ordinary catheterism. In my own practice, I generally find it most convenient to make the patient lie upon his back, near the edge of the bed, and to stand at his left side. His lower extremities should be perfectly unincumbered by the bedclothes, drawn up, and well separated; the head and shoulders are to be elevated by a large pillow; and the hands should be entirely out of the way, that no interruption may occur from any inadvertent or intentional movement on their part. The instrument, a small or middle-sized catheter, slightly conical at the extremity, well oiled and properly warmed, is now taken in the right hand, with the handle on a level with the median line of the abdomen, while the penis is held in the left hand perpendicularly with the trunk. The point of the catheter is now inserted into the meatus, and passed on as gently as possible to the seat of the obstruction. Waiting a few moments, to enable the parts to accommodate themselves as it were to the presence of the foreign body, the latter is gradually insinuated into the stricture, either by a steady backward pressure, or by a sort of rotatory movement, and afterwards passed on into the canal beyond it. When this object

has been accomplished, the instrument is either almost immediately withdrawn, or it is conveyed into the bladder, and retained there for twenty-four or forty-eight hours. The latter course is the one which I usually adopt, and which, as a general rule, I have rarely found objectionable. By this method I have frequently succeeded in restoring the urethra to its natural size in a few days, and, that, too, when the disease was of quite an obstinate character. When the dilatation is conducted upon this principle, it will sometimes be advantageous to use several catheters in succession, beginning with one that will readily enter and pass the stricture, and immediately after substituting one of larger diameter.

When the operation is thus *forcibly* performed, it is liable to be followed by inflammation of the urethra, and sometimes even of the neck of the bladder and the prostate gland. I have never, however, known it to assume a serious character from this cause in any case. Still, such an event might happen, and it is important that the young practitioner should be aware of the fact. The slight urethritis which generally ensues is speedily followed by the suppurative process, and the discharge of a small quantity of mucopurulent matter, similar to what is witnessed in the milder forms of gonorrhœa. The flow is usually of short duration, though I have known it occasionally to continue rather profusely for several weeks. A considerable bleeding sometimes attends the operation; and in a few instances I have seen it followed by severe pain, rigors, and high fever.

But dilatation is not always performed in this rapid and forcible manner. There is another mode of conducting it, more slow and gradual, if not more safe and free from suffering. The rule in this case is, to proceed as cautiously and gently as possible, to avoid all risk of irritation, commencing with an instrument that will readily pass the obstruction, and using afterwards a series of steadily increasing sizes until the cure is perfected. The introduction is repeated, at first, every second or third day, and subsequently, when the canal has become tolerant of the operation, once every twenty-four hours. When the dilatation has advanced considerably, it is a good plan occasionally to pass a small catheter, followed immediately by a larger one, which may be carried into the bladder, and then almost instantly withdrawn. Thus the treatment is conducted, gently and not forcibly, slowly and not rapidly, until the obstacle is surmounted, which will usually happen in from one to two months, according to the nature of the case, the skill of the surgeon, the

co-operation of the patient, and the absence or presence of complications.

In whatever manner the dilatation be conducted, whether forcibly or slowly, it is of paramount importance, after the cure is apparently completed, to introduce occasionally a large-sized catheter as far as the bladder. This may be done, at first, every third or fourth day, then once a week, then every fortnight, and at length once a month. Where this precaution is neglected, little hope can be entertained of a permanent cure, and the practitioner has sometimes the mortification to find a relapse in a few weeks. Before the patient is finally dismissed, he should be taught the introduction of the catheter.

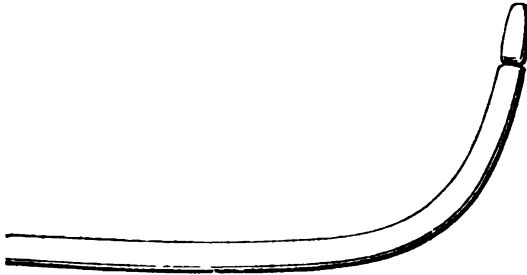
Dilatation, when performed in a slow and gradual manner, acts upon the principle of compression, stimulating the affected part, and causing absorption of the effused lymph upon which the coarctation depends. The effect, in fact, appears to be similar to that produced by a bandage, the only difference being, that, in the one case, the pressure is made from within outwards, and, in the other, from without inwards. The idea formerly entertained was, that it always produced ulceration of the affected part; but if this were the case, it would be more likely to cause the disease than to cure it. Even in forcible dilatation, such a result rarely, if ever, happens; for the little rents which are sometimes made by it are speedily closed with plastic lymph, which ultimately becomes organized and transformed into mucous tissue.

When the object is to dilate the parts very gradually, or when the process is obliged to be steadily maintained for a long period, benefit may be derived from the employment of the slippery elm bougie. This is made of the inner bark of the tree of this name, of cylindrical form, with a slightly conical extremity, and of suitable size. The surface is rendered as smooth as possible, first with a sharp knife, and afterwards with a wet woollen cloth. Prepared in this manner, it is sufficiently firm and even to admit of easy introduction, without the risk of breaking in the urethra, and slipping into the bladder; an accident which has several times happened to surgeons, and led to the necessity of an operation similar to that of lithotomy. The great merit of the slippery elm bougie is twofold: first, its soothing character, by which it tends to diminish the morbid sensibility of the urethra; and, secondly, its faculty of expanding under the natural moisture of the part, which it thus dilates and stimulates. Another advantage, of no inconsiderable

importance is, that the portion of the instrument corresponding with the stricture, swells during its sojourn in the tube, and thereby affords us, when it is withdrawn, an opportunity of judging of the extent and degree of the contraction.

When the stricture deviates to one side, and is at the same time very firm and unyielding, a silver catheter with a movable point may be used, though, I must confess, it is difficult to perceive its advantages over the ordinary instrument. Such a contrivance is sketched in the annexed drawing.

Fig. 167.



The process of dilatation is mainly applicable to soft and recent strictures. To those of an opposite character it is utterly unsuited, and should always give place to incision, either from within outwards, or from without inwards. I have no patience with dilatation for the removal of a hard, tough, narrow, and almost impermeable obstruction; such a disease cannot be managed successfully by such a procedure; the most prolonged use of the instrument can do no good, and is only calculated to deceive the patient and bring surgery into discredit.

2. *Compression*.—When the stricture is so hard and tight that it cannot be penetrated in the usual manner, an attempt may be made to remove it by pressing the end of the instrument against its anterior extremity. The operation is conducted upon the same principle as in gradual dilatation; and in general six or eight weeks elapse before the obstruction is so far overcome as to admit of the passage of a full-sized catheter. Ulceration and suppuration occasionally follow this treatment; effects which should be carefully avoided, since they have a tendency to aggravate the complaint.

I have not much experience with this mode of treatment, and I candidly confess that I have a feeling against it, amounting almost

to aversion. The only case to which it seems to me to be at all applicable is, where the stricture is situated in the membranous portion of the urethra, and is so tough and narrow as to resist the ordinary method. Here I might, perhaps, occasionally resort to it, but even then not with much hope of ultimate or permanent success. In the few instances in which I have had recourse to it, the benefit, if there was any, was extremely slight and transient. Sir Benjamin Brodie and some other distinguished authorities, however, declare that they have occasionally employed it with marked success.

The French surgeons occasionally resort to external compression; a mode of treatment which they have described under the imposing name of *malaxation*, a term synonymous with that of softening. It simply consists in carrying a bougie beyond the stricture, and in retaining it there as long as the patient can hold his water; at the same time that pretty firm pressure is made upon the affected part by means of the fingers, or a compress and bandage. The object is to stimulate the absorbent vessels, and to promote the softening of the organized and indurated lymph, upon the presence of which the contraction mainly depends. A modern writer, who has given a short account of this mode of treatment, seems to think well of it; for my own part, I am inclined to consider it as a futile and unsurgical proceeding, not likely to be employed by a man who has hands to act, and judgment to guide them.

3. *Cauterization*.—Cauterization, as a means of curing stricture, has been in use from time immemorial. Many of the older surgeons, in conformity with their peculiar, and, as they have since proved, erroneous, notions, that the disease generally depends upon the development of carnosities, excrescences, or fleshy growths, gave it a decided preference over every other method. Philippe, Alphonso Ferri, Aldereto, and Amatus Lusitanus, employed it with much success upwards of four centuries ago, and have given a particular description of the manner of performing the operation. Paré and Wiseman, the two most illustrious surgeons of their respective times, also warmly recommend it; and in the latter part of the last century it came almost into universal vogue, chiefly through the example and influence of John Hunter and Sir Everard Home. Its most distinguished advocates, at the present day, are Whately, Sir Charles Bell, Ducamp, Lallemand, and Amussat.

The practice of cauterization, once so prevalent, seems to be on the decline. In England, where, in consequence of the sanction of John Hunter, it was so long enthusiastically followed, it is now less

frequently employed than in any other country.¹ In the United States, where it has never had any very strong hold upon the profession, it is rarely resorted to by our best physicians. In France, on the contrary, it appears to be in very high repute, mainly, perhaps, on account of the encomiums lavished upon it by several of the most distinguished surgeons of that country.

Amid the great contrariety of opinion that has been expressed upon the subject, it is extremely difficult, if not impossible, to form a correct judgment of the value of the practice under consideration. Nor is the difficulty at all diminished when we reflect that caustic is frequently applied with different views; by some, simply as a sorbefacient, by others, as an escharotic; that some use it very sparingly, and others very freely; that some restrict it to particular cases or stages of the disease, and others employ it indiscriminately in all, no matter what may be the character, situation, or duration of the obstruction. For the solution of such a question, an amount of experience much greater than that which falls to the lot of any single individual is necessary. In considering the subject, it should not be forgotten that there is frequently a fashion in surgery as there is in medicine, and that particular modes of treatment are, on the one hand, often unjustly extolled, and, on the other, unjustly condemned. Cauterization, properly used, is a valuable curative agent; but if indiscriminately employed, it is capable of doing serious, if not irreparable mischief. The circumstances to which it appears to be more particularly adapted, and to which, in my judgment, it ought to be restricted, are those in which the stricture, without being very tight or extensive, is of a firm, gristly, and resilient character, and in which there is an undue amount of morbid sensibility of the mucous membrane of the urethra. I never resort to it where the obstruction is either very slight or very great; for, in the former case, I have rarely failed to effect a cure by dilatation, and in the latter I have almost always been obliged to have recourse to division. It may be further observed that cauterization should seldom be relied upon alone, but that its action should always be aided by the bougie or catheter; a mode of proceeding which greatly expedites the cure, and affords an additional guarantee against relapse, which is so apt to occur when this precaution is omitted.

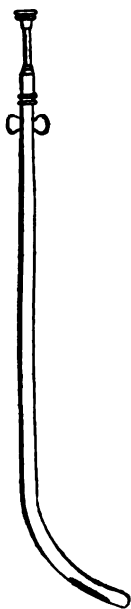
Cauterization, as practised at the present day, is generally effected with the nitrate of silver, originally suggested for this purpose by

¹ Johnson's *Medico-Chir. Rev.* July, 1842, p. 125.

Wiseman, and subsequently so highly lauded by John Hunter. Whately recommends the caustic potash, for which he claims the most extravagant pretensions. Ambrose Paré used a composition of powdered savin, ochre, antimony, and prepared tutty. Alphonso Ferri, and his contemporaries, employed equal parts of verdigris, orpiment, vitriol, and rock alum.

For applying the nitrate of silver, the best instrument of which I have any knowledge is the one represented in the adjoining cut. It is fashioned like a common silver catheter, and is either straight

Fig. 168.



or curved, according to the situation of the stricture. At the posterior surface of its vesical extremity is an eyelet, about three-quarters of an inch in length by two lines in width, which corresponds with the caustic in the cup, attached to the rod in the interior of the tube. The cup is partially filled with tallow, soap, or extract of hyoscyamus, which is next sprinkled with a thin layer of the powdered salt, when it is fit for use. This method is much better than that of melting the caustic into the cup, as is generally done, over the flame of a lamp. Lallemand's *porte-caustique*, which is commonly employed for cauterizing strictures, is objectionable, on account of the manner in which the cup, attached to the inner rod, is projected during the operation, thus rendering it liable to break off in the urethra. This occurrence is not imaginary, but real; for it has repeatedly been witnessed in practice, and cannot, therefore, be too carefully guarded against.¹ The instrument above figured, is free from all danger of this sort. Instead of the solid nitrate I use occasionally

a strong solution of this substance, in the proportion of from forty to sixty grains to the ounce of water, applied by means of a piece of sponge, attached to the end of the stylet of the *porte-caustique*.

The patient, during the operation, observes the same posture as in ordinary catheterism. The instrument being conveyed down to

¹ Several cases are upon record in which the end of the stylet broke off in the urethra, to the great horror both of the patient and his attendant. In one instance, that of a physician of Buffalo, who cauterized himself, the occurrence proved fatal. Such accidents should render practitioners extremely cautious in the use of this and similar instruments.

the stricture, or, rather, into it, the stylet, which was previously retracted, is now unscrewed, and pushed on until the cup is opposite the eyelet previously described. Then, by a sort of rotatory movement of the tube, the caustic is brought fairly in contact with the whole of the affected surface. No haste or violence is used in executing this step of the operation, but the entire proceeding is conducted with the utmost care and deliberation. The application is not continued longer than twenty, twenty-five, or thirty seconds, lest the caustic be too widely diffused over the surrounding surface, and is renewed once every fifth or sixth day. It is usually attended with some pain, and is followed by a frequent desire to urinate, by a sense of scalding in the urethra, and by a thin, sero-sanguinolent discharge, which in a short time assumes a muco-purulent character, and generally disappears altogether, along with the other symptoms, in four or five days. The application of the nitrate of silver, as conducted at the present period by enlightened and scientific surgeons, is seldom productive of much suffering or inconvenience. We no longer hear of the severe pain, the violent swoonings, the profuse hemorrhages, the distressing strangury, and the excessive constitutional reaction which followed the use of the remedy in the time of Hunter and of his immediate successors. Only a small quantity of the article is required at each application, and, if this be judiciously made, no possible harm can result in any case. Of the truth of this remark every practitioner, familiar with this substance, must be perfectly aware.

Nitrate of silver has been supposed to act as an escharotic. If this were the case, it would be more likely to occasion than to cure stricture; for it would lead to ulceration, and the reparative process which would follow could hardly fail to cause a narrowing of the canal. The fact is, the only effect which it produces is a detachment of the epithelium of the lining membrane, and a softening of the matter which gives rise to the obstruction; in other words, it acts mainly as a sorbefacient, rousing the absorbent vessels of the part, and inciting them to the removal of the adventitious deposit. The action of this substance is well shown upon an exposed mucous surface. If, for example, it be put in contact with the tongue, lip, or palate, it instantly causes coagulation of the natural secretion, slight, almost imperceptible shrivelling of the epithelial investment, and increased discharge from the mucous follicles. There is never any slough, or destruction of the vitality of the part, however large the quantity of caustic employed.

Mr. Whately, of London, strongly recommends, as was before stated, caustic potash, the *kali purum* of the old pharmacopœia, on the ground, as he alleges, that it possesses decided advantages over the nitrate of silver. Since the publication of his work on strictures, early in the present century, in which he first directed the attention of the profession to the subject, the usefulness of this article in the treatment of this disease has been attested by numerous practitioners, and can, therefore, be no longer a matter of doubt or dispute. I have myself employed it with the most happy effects, in cases in which the lunar caustic had failed to afford relief. Much prejudice has existed against this substance in the minds of surgeons, because they seem to think that its application must necessarily be followed by a slough. Nothing can be more erroneous than this opinion. Mr. Whately himself took great pains, in the work referred to, to explain its mode of action, and to describe the manner in which it should be used. He distinctly affirms that, if properly applied, it merely abrades without destroying the mucous membrane of the stricture; and in this view every one acquainted with the subject fully coincides. Without conceding to the caustic potash all the advantages that have been claimed for it by its advocates, and without yielding to it any superiority over the nitrate of silver, I am constrained to believe, both from my own experience and from the testimony of others, more competent, perhaps, to form a correct judgment upon the subject than I am, that it may often be turned to good account in the management of this disease, and that it is worthy of further trial. It cannot be supposed that an article which has been so frequently tested, and which has so long enjoyed the confidence of some of the most distinguished surgeons of the present century, can be wholly useless. The advocates of the nitrate of silver and the caustic potash, in attempting to ascertain the relative merits of these two articles, have not done each other justice; they have become exclusivists instead of eclectics; in the ardor of their controversy, they have permitted their zeal to outrun their judgment.

In applying the caustic potash, the same general rules should be observed as in the use of the nitrate of silver. Even the same instrument may be employed; a small quantity of the caustic, generally not more than the tenth of a grain, is mixed with a little lard, and introduced into the cup of the stylet. If the urethra be at all irritable, means should be taken to calm it before the operation, otherwise serious injury will be almost sure to follow. It is

well, also, as a general practice, to take an impression of the stricture, and to measure its precise distance from the external orifice of the urethra. Having observed these precautions, which are of no little consequence as it respects a successful issue, the instrument is passed to the seat of the obstruction, where it is permitted to remain for a few moments with the stylet advanced, to give the caustic time to dissolve and diffuse itself over the surrounding surface. It is then moved slowly backwards and forwards over the contracted portion until a feeling of heat is experienced, when it is instantly withdrawn. The rule is never to retain it long enough to produce a sense of burning, except in firm, gristly strictures, in which the caustic may be used with much greater freedom. The after-treatment does not differ from that of ordinary cauterization. When the pain is very severe, which, however, rarely happens, the urethra should be freely syringed with a solution of vinegar and water, to neutralize the alkali. The application, which is usually followed by the same train of phenomena as when the lunar caustic is employed, may be repeated every sixth or seventh day, according to its effects, and the circumstances of each particular case.

4. *Incision*.—When the stricture is very old, gristly, tight, and intractable, or indisposed to yield to dilatation, or dilatation and cauterization, incision must be practised. This operation is not of recent invention, for it appears to have been employed three hundred years ago by De Vega and Diaz. It was also performed at the beginning of the seventeenth century by Mayerne, in France. Soon after this period it fell into disuse, and so continued until it was revived by Doerner, of Germany. In the latter part of the last century, Dr. Physick employed an instrument, of a peculiar construction, for dividing strictures, a description and figure of which are to be found in the second volume of *Dorsey's Surgery*, published at Philadelphia in 1813. About the same time, or shortly after, similar attempts were made by Sir Charles Blicke, Mr. Grindel, Mr. Nayler and others, of England. To Mr. Stafford of London, however, is due the credit of having first brought this operation fully under the notice of the profession. In his work on Strictures, the first edition of which appeared nearly thirty years ago, he has given an elaborate description of the procedure, accompanied by drawings of ingenious and excellent instruments, which have since been variously modified and improved, either by himself or by others. The method by incision, as recommended and practised by Mr. Stafford and other surgeons, has met with much opposition, and has even been

denounced as barbarous and disgraceful. In such an opinion I cannot concur. I have performed the operation too frequently not to be convinced of its efficacy, if not of its superiority over all other plans.

When a stricture is very old, firm, and unyielding, or almost cartilaginous in its consistence, no mode of dilatation, however judiciously and perseveringly employed, can succeed, either alone or in combination with cauterization, and in such a case I never hesitate to resort at once to incision, satisfied that nothing else will answer. I have repeatedly had under my charge patients who had been subjected to the treatment by dilatation for months and months, without the slightest benefit, and who were almost instantly relieved by the operation under consideration. This fact has been witnessed again and again by my private pupils and by the public classes of the University of Louisville. And why should there be any hesitation or doubt concerning this operation? Where are its dangers, or the difficulties of its execution? I confess I cannot see any; and in making this remark, let no one regard me as a visionary enthusiast. What I say is not speculation, but the result of personal observation; not prejudice, but actual experience at the bedside. It is only when the stricture is situated far back, in the membranous portion of the urethra, that the method is obnoxious to objection. Under such circumstances, especially when the obstruction is nearly impermeable, or when it is accompanied by a tortuous condition of the urethra, there may, I admit, not only be danger in attempting division, but the operation requires an amount of skill and anatomical knowledge which few men possess. But even here the well-directed efforts of the patient and persevering surgeon will generally be crowned with success. To the unskilful alone is the operation a stumbling-block; to the ignorant, foolishness.

The instruments required for this operation vary according to the seat and nature of the stricture. For a coarctation of the orifice of the urethra, or for one just behind it, a narrow-bladed, probe-pointed bistoury will answer every purpose; but, for the remainder of the tube, the best instrument is that of Stafford, composed of a grooved canula, containing a stylet, armed with a little blade, which is made to project at will. The extremity of the canula, which is intended to lie within the stricture during its division, is of a conical shape, quite thin, and about three-quarters of an inch long. The instrument which I have been in the habit, for many years, of employing in permeable strictures, is represented in Fig. 169: *a* is the blade.

and *b* the canula, with the stylet and blade retracted. It is called the lateral-bladed stylet, and could not, I think, be improved. It is a perfect thing of its kind. For the impassable stricture, a urethral perforator is required. This consists of a round, graduated, silver tube, furnished with a stylet, at one end of which there is a lancet, while at the other there is a handle. Both these instruments, it may now be added, may be either straight or curved, according to the site of the stricture.

The annexed cuts afford an accurate idea of the instruments

Fig. 169.

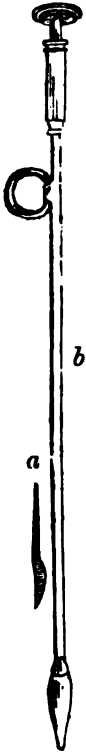


Fig. 170.



Fig. 171.



Fig. 172.



devised and used by Dr. Physick. Fig. 170 represents a straight canula and stylet for dividing strictures in the straight portion of the

urethra, and Fig. 171, a similar but curved instrument for operating on the curved portion. At Fig. 172 the lancet is separated from its sheath, to give a better idea of its shape.

Some years ago, Dr. R. J. Dodd, of the United States Navy, invented some instruments for dividing strictures, which seem well calculated for the purpose, but of which I cannot speak from personal experience. They are constructed in such a manner as to dilate, and at the same time, if necessary, to incise the contracted parts. A description and representation of these instruments will be found in the *American Journal of the Medical Sciences* for April, 1844.

A new urethrotôme, consisting merely of a slight modification of the lithotôme caché of Frère Côme, has been recently suggested by Mons. Maisonneuve,¹ of Paris, by whom it is considered as possessing extraordinary advantages over the instruments in common use. The principal changes are the greater length of the blade, and the more cylindrical form of the sheath, especially at its extremity; it is marked by the divisions of the mètre, and it is so arranged at its articulation that the blade, when required, can be opened in the same degree in its whole extent. The urethrotôme is introduced in the usual manner, and the stricture is divided from within outwards, as with Stafford's lancetted stylet, over which I do not presume it possesses the slightest superiority, if, indeed, it is equal to it.

A urethrotôme, on a similar but improved plan, was invented a short time ago by Dr. A. Hammer, of St. Louis, by whom it has been described at length in the third volume of the *Transactions* of the Medical Society of Würzburg, in an article on the nature, development, and treatment of stricture. An account of it, with a drawing, has also been published in the 32d No. of the *Gazette des Hôpitaux de Paris*, for 1854. I regret that my limits do not permit me to give a detailed notice of it.

With any of the instruments here mentioned the division of a stricture may, in general, be easily and safely effected. When the disease is seated just behind the opening of the urethra, I always employ a very narrow, blunt-pointed bistoury, with which the contracted part is freely cut in its entire length, either laterally, above and below, or at all these situations, according to the nature and extent of the obstruction. Another instrument which answers very well for performing this operation, is the small knife used by oculists for enlarging the incision in the cornea in extracting cataract.

¹ Bulletin Général de Thérapeutique, t. xlv. p. 169, 1854

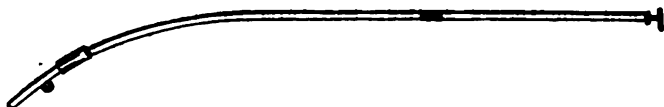
For cutting a stricture situated between the head of the penis and the bulbous portion of the tube, a straight, lateral-bladed stylet is the most convenient. The conical extremity of the instrument being securely engaged in the contracted part, the penis is drawn forward, and the lancet pressed steadily against the resisting surface until it is completely divided at two, three, or more points of its circumference. For a stricture of the membranous portion of the urethra, the most suitable instrument is a curved perforator, used upon the same principle as the lateral-bladed stylet, but with a degree of caution the greater, as this part of the canal is more intricate in its relations and direction. In whatever manner the operation is performed, the moment it is over a metallic catheter is passed into the bladder, and retained there, either permanently or a few hours every day, until the urethra has regained its natural diameter.

When the stricture is very long, or hard and tortuous, more than one operation may be necessary to effect its division. In such a case, the surgeon, having accomplished a part of his object, desists, and finishes the remainder at another sitting. In general, however, I prefer to do all that is necessary at one time. Dividing one part to-day, and another part to-morrow, is trifling with the patient's feeling; besides, we give him more pain, and induce greater inflammation than when the procedure is completed at one sitting. The usual effects of the operation are, first, a certain amount of pain, which, however, is rarely severe; secondly, hemorrhage, generally slight, but sometimes copious; thirdly, scalding in voiding the urine, with a frequent desire so to do; and, fourthly, rigors, followed by high fever and free perspiration. A false passage is sometimes made; but the occurrence is much more likely to happen in the hands of an ignorant than in those of a skilful surgeon.

5. *Scarification*.—As a modification of the operation of incision, allusion may be made here to scarification, which has attracted some attention within the last fifteen years, particularly in France and this country, in consequence chiefly of the high commendations of my friend Dr. Dupierris, of Havana. In his *Mémoire sur les Retrécissemens Organiques du Canal de l'Urètre*, of which a second edition was issued at Paris in 1847, this gentleman has given a full account of the method of performing the operation, and pointed out what he conceives to be its peculiar advantages. The instrument which he uses, and of which he is the inventor, is constructed upon the same principle as that of Stafford, and is either straight or curved, according to the seat of the stricture.

The annexed cut will afford a better idea of it than any description, however elaborate. Its distinguishing feature is a little

Fig. 173.



lancet-shaped blade, which is secured to the lower extremity of the stylet, and admits of being moved backwards and forwards through a lateral slit in the beak of the canula. The instrument, called the coarctotome, is introduced in the same manner as a common catheter, sound, or bougie. If there be any difficulty in engaging its beak in the stricture, it may be easily surmounted by rotating it upon its axis, and pulling forward the penis. The resistance offered to the instrument, and to the finger applied to the seat of the obstruction, will indicate whether the part referred to is in its proper situation. When this has been ascertained, the surgeon moves the stylet of the coarctotome forwards and backwards, and thus notches the stricture on one side. When the disease involves the greater portion of the canal, or its entire circumference, and it is deemed advisable to scarify it at several points, all that is necessary is to turn the instrument round, which can be easily done without the trouble or inconvenience of withdrawing and reintroducing it. The operation being completed, a catheter is carried into the bladder, and the case treated upon general principles.

The operation is seldom attended with much pain, or any hemorrhage. When the stricture is not very large or firm, one or two scarifications are generally sufficient; but when the case is different, it may be necessary to repeat them as often as six or eight times, at intervals of so many days. Some inequality or roughness now and then remains at the incised part, especially when the healing process has been unusually tardy or imperfect; this is best remedied by cauterization.

Scarification, as a remedy for the cure of stricture, acts in the same manner as incision, of which, as was before intimated, it is merely a modification. The process is best adapted to the milder varieties of firm, gristly contractions, seated in the spongy portion of the canal. I should certainly not resort to it either in the very simple or very aggravated forms of the malady; in the first it would be unnecessary, in the second, inadequate.

6. *Perineal Section*.—Professor Syme having, like many other practitioners, found that there are certain cases of stricture which obstinately resist the treatment by dilatation, however perseveringly and skilfully employed, has devised a remedy which, he thinks, will effectually answer the purpose in every instance in which it is properly used. This is nothing less than the division of the stricture by an external incision, extending down through the urethra, and embracing the whole of the constricted surface. The operation is different from that described by some of the older surgeons, and known for a long time past, among French writers, as the "button-hole" process. The latter, as will be presently seen, is generally restricted to impassable strictures, while the operation of the Edinburgh professor contemplates the division of strictures which still admit of the introduction of instruments, although only of very small size. Mr. Syme, as has been stated elsewhere, denies that there is such a thing as a truly impermeable stricture, and it is upon this peculiarity in his views that the operation under consideration is based. "There are," he remarks, "two forms of stricture in which mere dilatation has been found inadequate to afford relief. In one of these, the contracted canal is so extremely irritable that the introduction of an instrument aggravates instead of alleviating the symptoms, and exposes the patient to various dangers, from the local and general disturbance thus excited. In the other, the peculiarity consists in a contractile tendency so strong as quickly to counteract the effect of dilatation, and thus render it useless."¹ This extract will sufficiently explain the views of Mr. Syme, and place the subject beyond the contingency of misrepresentation.

The first time that Mr. Syme practised this operation was in 1844,² in a case of stricture in which he had employed, for a long time and to the fullest extent, first, dilatation, and afterwards internal incision, according to the more ordinary methods, without conferring any essential or permanent benefit upon his patient, who had himself become disgusted with the treatment, and was ready to submit to any operation, however severe and hazardous, that held out the least prospect of relief. The parts were accordingly divided in the manner already indicated, and complete recovery was the consequence; the man, when last heard from, eight years after the operation, being perfectly well and free from local disease.

¹ Edinburgh Monthly Journal of Medical Science, July, 1852, p. 33.

² Edinburgh Monthly Journal of Medical Science, October, 1844.

In performing the operation, which Mr. Syme originally described under the appellation of "external division," but which is now more generally known under that of the "perineal section," the patient is placed in the same situation, and tied up in the same manner, as in the operation of lithotomy. A sound, slightly curved, and sufficiently small to pass readily through the stricture, is then introduced into the bladder, and intrusted to an assistant. The parts being shaved, the nates are brought to the edge of the table, and the surgeon, sitting on a suitable chair, or resting upon one knee, begins his incisions, which should be made exactly in the middle line of the perineum, the raphé serving as a guide to the instrument. Having divided the superficial structures, he feels for the staff, and plunging his knife into its groove, he cuts the indurated and contracted tissues through their entire extent, thus laying the surfaces completely open, precisely as in the operation for anal fistule. The whole wound does not exceed an inch and a half, and occasionally it need not even be so large. Care should be taken, as Mr. Syme particularly enjoins, not to divide the deep fascia of the perineum, lest extravasation of urine take place. As soon as the stricture has been thoroughly opened, a medium-sized catheter is carried into the bladder, where it is to be retained by suitable apparatus, for forty-eight or seventy-two hours, when it is removed, and in a few days reintroduced.

A prolonged sojourn of the instrument is unnecessary, and even improper, as it is liable to give rise to irritation of the bladder and to various constitutional affections, highly prejudicial to a rapid and favorable cure.

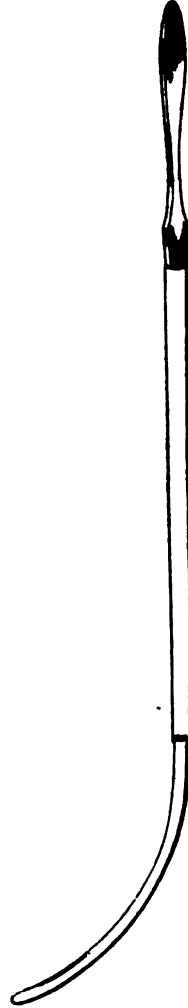
An ordinary staff, with a central groove, moderately curved at the vesical extremity, and sufficiently small to pass with facility through the strictured part, and a straight, narrow-bladed, sharp-pointed scalpel, are the only instruments required for the operation. Very recently, Mr. Syme¹ has constructed a staff for the express purpose of simplifying the whole procedure, and thus enabling the surgeon to make his incisions with greater ease and precision. The instrument, which is represented in the annexed sketch (Fig. 174), on a scale exactly half the actual size, is very slender at the vesical extremity, and is thus readily passed through the stricture into the bladder, while the other portion, which is as large as a No. 8 catheter, stops abruptly in front of the obstruction, thereby indicat-

¹ Edinburgh Monthly Journal of Science, August, 1853.

ing its anterior limit, and the point, consequently, at which the incision should terminate in this situation.

Concerning the propriety of this operation, under certain circumstances, no surgeon of experience can, it seems to me, entertain the slightest doubt. Every one, as Mr. Syme has said, must meet with cases in which the ordinary plans are either inapplicable, or in which, if they are resorted to, they are utterly inadequate to afford permanent relief. I can solemnly aver that I have repeatedly seen such cases myself, and I am very certain that they are sufficiently common in every community. But, in making these remarks, I do not wish to be understood as being an indiscriminate advocate of this operation; on the contrary, I cannot too pointedly condemn such a course. The operation has already been performed too frequently, and to no one is this charge so applicable as to the inventor of it himself, who, in the short space of ten years, has performed it upwards of seventy times. Mr. Syme is one of the principal surgeons of Scotland, and his reputation, doubtless, attracts many cases of bad stricture; but whether some of these cases could not be overcome by more simple means, is, to say the least, very questionable. The desire to popularize the operation with the profession may not, perhaps, be altogether without its influence with this distinguished surgeon in the selection of his subjects. We read that the operation has met with much opposition in France and Ireland,¹ and also in certain parts of England; while in this country, if it has not experienced a similar fate, it has hitherto received very little countenance. I think it may be

Fig. 174.



¹ My friend, Dr. G. C. Blackman, during a visit to Dublin, in 1868, was assured by Mr. Porter, the president of the Royal College of Surgeons of Ireland, that the operation of Mr. Syme had never been performed by any one in that city, and he would venture to assert that it never would be. Mons. Civiale, it would seem, according to the same authority, has never employed it, whereas he frequently resorts to the button-hole incision.

safely maintained that all, or nearly all, strictures that are not positively impermeable to urine, or situated in the membranous portion of the urethra, or complicated with perineal fistule, false passages, or great and extensive induration of the surrounding structures, admit of permanent, and, in most instances, of prompt cure, by dilatation, either alone, or aided by incision, and other means. The results, at least, of my own practice bear me out in this assertion, which is, moreover, if I mistake not, in strict conformity with the experience of the profession generally upon this subject.

The results of this operation, as far as they are known, are eminently encouraging, exhibiting, as they do, a most extraordinary array of success. Mr. Henry Thompson has paid special attention to this subject, and in his large treatise on *Stricture of the Urethra*,¹ recently published, he has given the results of one hundred and thirteen cases of the perineal section. Of these, seventy occurred in the practice of Mr. Syme, and forty-three in that of other surgeons, as Coulson, Fergusson, Cock, Erichsen, Mackenzie, and Fiddes. The results, in the great majority of the cases, were perfectly successful, in a few partially successful, in four doubtful, and in four fatal; the cause of death in each of these being purulent deposits in different parts of the body. None of the patients, save one, seem to have experienced any serious detriment from the loss of blood, which, in many of the operations, did not exceed a few drachms, or, at most, an ounce.

In a short paper on the perineal section in the *New York Journal of Medicine and Surgery* for March, 1855, by Dr. Frederick D. Lente, of West Point, is a tabular statement of twenty-three cases in which this and the "button-hole" operation were performed by the surgeons of the New York Hospital. Of these cases, of which the relative proportion is unfortunately not given, three died, five were relieved, and fifteen were cured. The causes of death were peritonitis, coma, and suppuration. In most of the patients, the operation was performed under very unfavorable circumstances, and as a dernier resort, all other means having failed. The stricture in nearly all the cases existed in the membranous portion of the urethra, and in quite a number of them it was the result of external injury. Dr. Lente adds that the surgeons of the New York Hos-

¹ The Pathology and Treatment of Stricture of the Urethra, being the Jacksonian Prize for the year 1852, p. 257. London, 1854.

pital were in the habit of performing both these operations at least twenty years ago, and consequently a number of years before Mr. Syme executed the perineal section, a procedure which now bears his name.

It is, perhaps, too soon to attempt to form an estimate of the relative proportion of cures and relapses after this operation. Scarcely ten years have elapsed since it was first performed, and it is not reasonable to suppose that the different cases that have since occurred have been sufficiently watched to justify us in making them the basis of statistical calculations. When the stricture is thoroughly divided, when there is no unusual complication, and when the patient is properly treated, both before and after the operation, the number of relapses will, I presume, be comparatively small.

There are two most important circumstances which should claim attention after every operation of this kind; the first is, to regulate the general health, and the second, to insist upon the frequent use of the catheter, in order that the advantages gained by the operation may not be lost, or, what amounts to the same thing, that the stricture may not be reproduced. The same rules that govern the surgeon in the treatment of his patient after the operation by dilatation or incision are applicable here, and should always be most scrupulously enforced. The instrument should be passed, at first, at least once every fourth or fifth day, and afterwards once a week, then once a fortnight, and, finally, once a month, until all danger of relapse is over. Horseback exercise, sexual indulgence, and stimulating food and drink should be carefully avoided; the bowels should be constantly maintained in a soluble state, and the strictest attention should be paid to the secretions.

7. *External Division—La Boutonnière, or Button-hole Incision.*—This plan of treating stricture, originally practised in the seventeenth century, has been lauded at one period, and denounced at another, according to the good or bad luck of those who have employed it. For a long time, indeed, it was almost completely neglected, and it has only been within the last ten years that it has been prominently reintroduced to the notice of the profession. In 1824, Dr. H. G. Jameson, of Baltimore, published an elaborate *Essay on Stricture of the Urethra*, in the seventh volume of the *Medical Recorder*, in which he detailed a considerable number of cases of this disease which were promptly and permanently relieved by this mode of management. The paper in question is one, I conceive, of great value, and

it is very surprising that it has not attracted more attention in this country. At the time of its appearance, the author of it had probably performed the operation more frequently than any other surgeon in America or Europe. Successful results by this procedure had been previously obtained by Collet, Wiseman, J. L. Petit, J. Hunter, Lassus, Brandi, Desault, Eckstrom, Levanier, and other practitioners.

A diversity of opinion appears to be entertained as to what really constitutes this operation. "From reading authors, both ancient and modern," says Desault,¹ "it is difficult to form an accurate idea of the operation of *la boutonnière*. It is performed in so many different ways, and the operative processes exhibit such contrariety, and such little resemblance, that we cannot contemplate this subject under any general point of view. The parts that are divided differ according to the place where the operation is performed, and this place cannot be determined except by the nature, and especially by the seat of the disease. Sometimes only a single incision is made in the canal of the urethra, as in the operation for the stone by the great apparatus; sometimes the incision is prolonged as far as the neck and body of the bladder. Sometimes only the body of this viscus is attacked, as in the operation for the stone by the lateral apparatus. It is, therefore, only by the separate consideration of each of these methods that we can form a clear idea of the operation of *la boutonnière*."

The button-hole operation, as the term *la boutonnière* literally signifies, is generally limited, if I mistake not, at the present day, to impassable strictures, situated in the membranous portion of the urethra, or in that division of the tube which corresponds to the perineum, although, as has been already seen, Desault considered it as also applicable to strictures admitting of the introduction of the staff. It would be well, I think, if the process could be made to include the external division of hard and impermeable coarctations, no matter in what part of the urethra they may be located. The effect of such an arrangement would be to avoid confusion between this operation and the perineal section above described.

In performing this operation, the patient is placed in the same position as in lithotomy; the hands and feet are bound together; and two persons take charge of the limbs. A staff or grooved director, either straight or slightly curved, is conveyed to the seat

¹ Surgical Works by Xavier Bichat; Translated by E. D. Smith, M. D., vol. ii. p. 284. Philadelphia, 1814.

of the obstruction, and confided to another assistant, who also holds up the scrotum. The surgeon, sitting on a low chair, or resting upon one knee, takes a narrow-bladed scalpel, and makes an incision into the raphé of the perineum, about an inch and a quarter in length, taking care, on the one hand, not to interfere with the rectum, and, on the other, not to extend it too high up towards the bulb of the urethra. The knife is plunged in, at the first stroke, to a considerable depth, and is then used to divide, by successive touches, the parts overlying the stricture. Feeling now for the end of the staff, the point of the instrument is inserted into the contracted part, which is next freely divided in a direction from before backwards. A catheter is next introduced into the bladder, and the case is treated, to all intents and purposes, as one of lithotomy. There is usually little bleeding, and the wound seldom remains open beyond the fifteenth or eighteenth day. After the first forty-eight hours, the catheter need not be used oftener than once a day, but this practice should be persisted in for a long time, otherwise relapse will be inevitable, such is the tendency in these cases to contraction. When the operation has been well executed, the cure is generally permanent.

I have performed this operation altogether eight times, and in every instance, save one, with the most satisfactory results. The exceptional case was that of a young man, aged twenty-one, a shoemaker by occupation, from the State of Illinois. It occurred upwards of thirteen years ago, and in executing the operation, I had the kind assistance of my friend Dr. Cobb, at the time Professor of Anatomy in the University of Louisville. The patient had ruptured his urethra several years previously, in consequence of a fall astride the post of a chair. The parts gradually healed, leaving a narrow fistulous opening far back in the perineum, through which, with great difficulty, he voided his urine, none passing by the natural channel. No catheter, even of the smallest size, could be introduced into the bladder. The operation, above described, was performed with hardly any trouble, and the patient remained perfectly well for five or six months, when, in consequence of neglect to use the catheter, a relapse gradually occurred, and his symptoms became as bad as they had been before.

The operation is by no means free from danger, and requires the most consummate skill for its successful execution. None but a madman or a fool would attempt it, unless he had a profound know-

ledge of the anatomy of the parts, and a thorough acquaintance with the use of instruments. Of all the operations of surgery this is the least to be coveted. I well recollect the impression which it made upon me, many years ago, during my residence in a neighboring city. The patient, the subject of it, was an old colored man, who had been afflicted for a long time with a tight, gristly stricture of the membranous portion of the urethra, attended with frequent micturition, vesical catarrh, and excessive irritability of the urethra. Various but fruitless attempts had been made to pass a catheter. The urine trickled constantly away, the bladder was never entirely empty, and the general health was completely wrecked. Life was fast ebbing away, and it was evident that something must be done, and that speedily, to relieve the patient. An operation was decided on, and a long time was occupied in its performance, during which big drops of sweat rolled in profusion from the young surgeon's forehead. Chloroform was not then in use, and the poor man suffered the torments of the damned. The tale is soon told. After several hours had been spent in idle efforts to reach the bladder, the operation was abandoned in despair; the patient was unbound and put to bed, and, in two days after, he was carried to his grave. Such a case needs no comment; it speaks for itself. I am sure I shall never forget it.

In another case, which I witnessed when a student, the whole urethra, from the meatus to the scrotum, a distance of upwards of five inches, was laid open by the operator. The patient was a young man, hardly twenty years of age, and the stricture was exceedingly close and firm. A catheter was introduced into the bladder, and the edges of the wound in the skin were approximated by numerous points of the interrupted suture. Violent rigors, with severe inflammation of the parts, ensued, and for a few days the patient was in a critical condition. But little of the wound united by the adhesive process, and several fistulous openings existed when I last saw the case, more than a year after the operation.

Fortunately such an operation is seldom required. It was certainly not necessary in the case just mentioned. It is chiefly when the stricture is situated in the membranous portion of the tube, and is impermeable to the bougie, catheter, or lancetted stylet, that it can be proper.

Several cases of this operation have recently been reported in which death occurred in consequence of hemorrhage, "shock," severe inflammation, or purulent infiltration.

INJURIOUS EFFECTS OF OPERATIONS ON THE URETHRA.

In bringing the subject of stricture in the male to a close, it is necessary to state that the different methods of treatment, now described, are all liable, however carefully or judiciously conducted, to be followed by very serious and even fatal consequences. It is well known that patients, especially such as are very nervous and irritable, occasionally suffer most violently from the most trifling operations upon the urinary organs, the mere passage of a bougie, sound, or catheter inducing violent rigors, excessive prostration, and other unpleasant symptoms. Indeed, quite a number of cases are upon record, in which death was produced by this cause, even when there was no severe disease. Where is the practitioner, of any experience in this branch of surgery, who has not witnessed the distress, local and constitutional, which healthy persons often suffer from an attempt to pass an instrument into the bladder? The sensibility of the urethra is naturally very great, and hence it is not surprising that the contact of a bougie, however slight, should occasionally be followed by great pain in the part, nervous prostration, and other disagreeable effects. Fortunately, all persons are not constituted alike in this particular, otherwise these effects would be of much more frequent occurrence than they are found to be in practice. The treatment of stricture, however, is peculiarly liable to be attended with pain and other unpleasant symptoms, owing to the fact that many, if not most of the subjects of this disease are remarkably prone to derangement of the general health, and, therefore, easily affected by the most trivial operations performed for its relief.

In another class of cases, a still more serious effect is occasionally witnessed, as the result of operations upon the urinary organs, especially the urethra, and the neck of the bladder. I allude to the occurrence of acute arthritis, or the formation of matter in the joints, muscles, veins, cellular tissue, and other structures. The patient is seized with rigors, which, after having continued for a variable period, are followed by profuse sweats and a sense of excessive prostration. The disease in fact, at its commencement, frequently resembles an attack of ordinary intermittent fever, the paroxysm sometimes recurring with the same degree of regularity once or twice in the twenty-four hours. Occasionally, again, it closely simulates an attack of gout or rheumatism, especially when there is intense pain

in the joints and limbs. In whatever manner it makes its appearance, the case soon assumes a most threatening character. The pulse becomes small and frequent, the appetite declines, the tongue is covered with a brownish fur, the stomach is irritable, the bowels are costive, the urine is scanty and high-colored, and there is excessive thirst, with constant restlessness and great anxiety of mind. Delirium and stupor generally set in at an early period, and constitute prominent phenomena of the complaint.

The symptoms now described may come on within a few hours after the operation, of which they are the consequence; but, in general, they do not show themselves under two, three, or four days, at all events not with any degree of severity. They soon assume a typhoid character, and few patients survive beyond a week, ten days, or a fortnight. The formation of matter is usually preceded and accompanied by an erysipelatous blush of the skin, by exquisite tenderness of the part, and by great impediment of motion. The pus, which often exists in considerable quantities, either as a simple collection, or in the form of distinct abscesses, is commonly of a sanious and unhealthy character, presenting the aspect rather of imperfectly elaborated lymph than of genuine matter: in some instances, it is highly fetid. The structures which are most liable to suffer are the joints, as the knee, ankle, hip, and shoulder, the muscles and cellular tissue of the extremities, the perineum and scrotum, the cellular substance and veins of the pelvis, the liver, and spleen. The number of abscesses is sometimes very great, and when this is the case, they are always proportionably small.

Effects similar to the above occasionally follow lithotomy and lithotripsy, the formation of false passages, and injuries of the prostate gland. It is not known what influence, if any, is exerted upon these occurrences by age, temperament, occupation, and mode of life. Persons, apparently the most healthy, occasionally suffer severely and even fatally from the most trivial operations, not only upon the genito-urinary apparatus, but upon other parts of the body.

Mons. Velpeau¹ met with an instance in which the passage of a bougie was followed, the day after the operation, by symptoms of tetanus. The patient had a violent chill the evening after the introduction of the instrument, which, as the stricture was very slight, was effected without difficulty; and he expired twenty-four hours after the appearance of the first signs of the disease. At the autopsy,

¹ *Leçons Orales de Clinique Chirurgicale*, t. 3, p. 326. Paris, 1841.

the urinary organs were found to be perfectly healthy, and nothing whatever could be discovered to account for the fatal termination of the case.

In regard to the unpleasant nervous symptoms which occasionally succeed these operations, much may be done in the way of prevention by the use of chloroform; but where they are unavoidable, no time should be lost in moderating and relieving them. Promptness of action is here, indeed, of the greatest importance, for upon it often depends the safety of the patient. The treatment is plain and simple. From one to two grains of morphia, according to the age and condition of the patient, are given at a single dose, along with a liberal quantity of brandy, or brandy and spirits of camphor—a combination which is peculiarly soothing both to the part and system—the extremities and even the spine are covered with sinapisms, and cloths, wrung out of hot water and laudanum, are steadily maintained upon the genitals, the perineum, and the hypogastrium. If undue reaction takes place, abatement may be sought with the lancet and tartar emetic, or calomel and ipecacuanha; but these remedies must be employed with great caution, otherwise they may induce injurious debility.

Arthritic symptoms, and the formation of matter in the cellular tissue, joints, veins, muscles, and viscera, must be met by leeches, blisters, iodine, and warm fomentations, medicated with laudanum and acetate of lead, and by the internal use of calomel and opium, aided, if necessary, by suitable stimulants, as carbonate of ammonia, quinine, wine, brandy, and porter. Superficial abscesses must be opened by early and free incisions, both to relieve pain, and prevent farther contamination of the system. Unfortunately, however, as already intimated, no mode of treatment, however early or judiciously employed, can avail much under such circumstances, death being the lot of almost every patient thus affected.

STRICTURE OF THE URETHRA IN THE FEMALE.

Stricture of the urethra in the female is exceedingly infrequent, so much so, indeed, that many practitioners are disposed to deny the possibility of its occurrence. The reason of this difference in the two sexes is sufficiently obvious. In the first place, the canal in the female is not only much shorter than that of the male, but also much more dilatable, thus affording a much smaller surface for the

play of morbid action, and one also much more capable of resisting the effects of morbid impressions. But there is another reason, and one which exerts a still more powerful influence in preventing the development of this disease in women. In the male, the most common cause, by far, of stricture is gonorrhoea, a disease which is very rare in the female, and which, whatever may be its violence, seldom seriously affects the urethra, but expends itself mainly upon the vulva and vagina, whereas in the male it often invades the entire canal, and resists for weeks and months every mode of treatment that can be devised for its relief. The most common cause of the malady is external violence, as a blow, or contusion, the effect of the pressure of the child's head during parturition, or the maladroit use of the forceps. Considerable obstruction of the urethra in the female is sometimes produced by the presence of a small tumor, or vascular excrescence. The disease may also be produced by chancre.

The obstruction may occur at any point of the tube, but in most instances it is seated just behind the external orifice, where it presents itself in the form of a narrow, ring-like constriction, not unlike what might be supposed to result from tying a piece of twine around the parts. Occasionally the stricture is several lines in length, and in a few rare instances it has been found to occupy the entire canal from one extremity to the other. Such a case as this fell, not long ago, under my own observation, and is described at length in the article on vesico-vagino-rectal fistule. The coarctation may, as in the male, affect the entire circumference of the tube, or it may be limited to one or more points; and in either case it may be very slight, or so great as to interfere most seriously with the evacuation of the urine, or even entirely prevent it, as in the remarkable example to which I have just adverted.

The symptoms and effects, local and general, of stricture of the urethra in the female, do not differ from those of the same disease in the other sex, and they do not, therefore, require any particular notice in this place. The treatment also is similar.

In the milder forms of the affection, the proper remedy is dilatation, aided, if necessary, by incision. In the case, already adverted to, of complete obstruction of the tube, in a colored woman, twenty-seven years of age, I succeeded in re-establishing the passage by puncturing the bladder by means of a curved trocar carried in the direction of the canal beneath the pubic symphysis, the instrument being guided along by the finger in the vagina. A self-retaining catheter was immediately inserted into the organ, and worn until

all danger of reunion of the raw surfaces was over. The disease, which was associated with vesico-rectal fistule and obliteration of the vagina, had existed upwards of three years, and had arisen in consequence of injury sustained during the extraction of the child's head in an unusually protracted labor. The success was prompt and most satisfactory. The urine at once resumed its natural channel, and in a few days ceased entirely to pass off by the bowel.

Cauterization may become necessary when the coarctation is conjoined with excessive morbid sensibility of the canal; but there are, I presume, few cases which will be likely to recover permanently under such treatment alone. Obstruction dependent upon the presence of a tumor or vascular excrescence, must be relieved with the knife, scissors, or escharotics, the best of which is the acid nitrate of mercury.

The orifice of the female urethra is liable to occlusion, both congenital and acquired. The former variety is sometimes effected by an abnormal development of the hymen, which, instead of terminating at the usual point, is reflected upwards over the external meatus, thus completely preventing the passage of the urine. An instance of this description is mentioned by Hammann,¹ a German writer, in which the adventitious process was nearly two lines in thickness. Occasionally the membrane is very thin, consisting merely of a duplicature of the mucous coat of the urethra; and in a few rare cases it has been found to be pierced by a small orifice, permitting the partial escape of the urine. Sometimes this malformation coincides with the persistence of the urachus, as in the case of the young girl mentioned by Cabròl, who had a urinary fistule at the umbilicus. When the obstruction depends upon disease, as inflammation, whether common or specific, it is almost always incomplete. It need hardly be added that the orifice of the urethra of the female, like that of the male, is liable to be blocked up by polypoid growths and calculous concretions, the latter being sometimes arrested here in their attempt to escape from the bladder.

When the obstruction is caused by the presence of an abnormal membrane, or the extension of the hymen, nothing short of the free division of the part will be likely to afford the requisite relief. In general, it will be necessary to make a crucial incision, taking care afterwards to prevent the reunion of the raw edges by the use of the bougie, a sponge-tent, or self-retaining catheter. When the

¹ *Medico-Chirurg. Aufsätze, historisch-praktischen Inhalts.* Berlin, 1778.

orifice is merely contracted, whether as a congenital vice, or as the result of chancre, gonorrhoea, or other disease, the obstacle may be overcome either by dilatation alone, or by dilatation, aided by incision of the sides of the affected opening. Polypoid tumors are excised; calculous concretions, extracted.

CHAPTER IV.

POLYPOID AND VASCULAR TUMORS OF THE URETHRA.

MUCH confusion has hitherto existed in the minds of pathologists respecting certain morbid growths of the urethra, known by the name of polypous tumors, fleshy vegetations, and warty excrescences. This confusion will not be likely to be removed as long as writers and teachers continue to attach different meanings, expressions, or ideas, to the same disease. The term polype is often used in a very vague sense, and may, therefore, denote little, much, or nothing at all, according to the peculiar views of each particular author. Whether genuine polypes, such as are found in the nose, vagina, and uterus, ever form in the urethra, is a point which has not been clearly established by observation, either during life or after death. For my own part, I can perceive no reason why they should not, seeing that this canal is lined by the same kind of structure as the parts just mentioned; which, it is well known, are not unfrequently the seat of this variety of abnormal growth. Be this as it may, there is no doubt that excrescences occasionally form in the urethra, which, from their texture and organization, closely resemble polypous tumors, and to which, consequently, we may, to say the least, with great propriety, apply the term polypoid.

Polypoid Tumors.—These tumors occur in both sexes, and in different portions of the urethra. In the male, the most common site is the anterior part of the tube, just behind the urinary meatus; sometimes they are situated further back; and, in a case mentioned by Amussat, they existed in the membranous division of the canal. In women, they are also generally situated superficially, so that during their progress they not unfrequently project beyond the external orifice of the urethra. In rare instances, they occupy the posterior

part of the tube, and may then pass into the bladder, just as a polype of the nose sometimes hangs into the throat.

In the male, to whom the succeeding account is intended chiefly to apply, the number of these tumors varies from one to three or four; frequently, they are solitary. In their volume, they range between the smallest pin's head and an ordinary pea. Their shape is irregular; pyriform, conical or spheroidal. They are of a reddish complexion, soft and spongy in their consistence, and of a mucous structure. Their surface is sometimes perfectly smooth; at other times slightly granulated, rough, or studded with villousities. When minutely examined, they are found to consist of a cellular, or cellulo-vascular substance, invested by a prolongation of the lining membrane of the urethra. The annexed sketch (Fig. 175), copied from Mr. Thompson's work on stricture of the urethra, affords an admirable view of a tumor of this description. It was situated at the junction of the membranous and prostatic portions of the tube, was about nine lines long by three in width, and had produced all the symptoms of stricture.

Fig. 175.



How these little bodies are formed, is still a disputed point. The probability is that they are the result merely of a species of hypertrophy of the mucous villi of the urethra, produced by an exaltation of the common process of nutrition. In what respect, if any, their development is influenced by inflammatory irritation, we have no means of determining. In one instance, that of a young man of twenty-four, who was under my charge last summer, the tumor, which was situated just behind the urinary meatus, and of the size of a hemp-seed, was evidently of a gonorrhoeal origin.

These polypoid tumors are generally free from pain, in which respect they differ, and that remarkably, from the vascular growths described below. They rarely advance beyond the size above-mentioned, are usually unattended by mucous, gleet, or purulent discharge, and seldom materially obstruct micturition. Their development is tardy and insidious, and they generally manifest no disposition to reappear after extirpation. When deep-seated,

they may exist for many years, without the possibility of detection.

The removal of these excrescences is best effected by excision with the knife or scissors. When situated in front of the canal, just behind the external orifice, a small iris-knife may be used. In whatever manner the excision is accomplished, the surface should always be touched immediately after with nitrate of silver or sulphate of copper, to destroy every ramification of the abnormal structure. When such a tumor is deeply seated, and acquires an unusually large bulk, it may be pinched off with a pair of urethra-forceps; or, where this is impracticable, an incision may be made down upon it through the spongy body of the penis.

Vascular Tumors.—The second variety of morbid growth of the urethra is generally denominated the “vascular tumor,” or “fleshy excrescence.” It is very different in its structure from the preceding, and is in great measure, if not entirely, peculiar to the female, being usually situated just within the margin of the urinary meatus, or in the anterior portion of the excretory tube. In some instances, however, it lies farther back, and may then project slightly into the bladder. Cases also occur in which it occupies the parts immediately around the urinary meatus. Occasionally, though rarely, the excrescences are found simultaneously in all these situations.

Although incidentally noticed by Morgagni and other pathologists of the last century, this variety of tumor was first accurately described by Sir C. M. Clark, in his work on the Diseases of Females. Good accounts of it have also been published by Boyer, Wardrop, Kaldebrand, Rosenmüller, Dubois, Prochaska, Lever, and Bavoux. In this country, the attention of the profession was first prominently directed to the subject by Dr. Alexander E. Hosack, of New York, in an able article in the *American Journal of the Medical Sciences* for February, 1840.

The fleshy excrescence of the urethra is of a bright florid color, exquisitely sensitive, and of a conical, ovoidal, or rounded form. In its volume it varies from that of a large pin's head to that of a currant, a pea, or a cherry, which latter it rarely exceeds. Its attachment is generally by a tolerably broad base, but in many cases, especially when it is pyriform, it adheres by a narrow pedicle. In number, it varies from one to ten or fifteen, though, in general, it does not exceed three or four. Frequently, in fact, it is solitary. When several exist, they are either isolated, or grouped together. In its structure, this variety of tumor is essentially vascular, and

hence it frequently bleeds upon the slightest touch. Minutely examined, it is found to consist of a congeries of minute vessels, arterial and venous, which are connected together by delicate cellular tissue, and invested by a prolongation of the mucous membrane. From the exquisite pain of which it is the seat, it is evident that it must also be well supplied with nerves, though it is not easy to demonstrate their existence. Thus constituted, it is of a soft, spongy consistence, and of an erectile character, with a smooth and florid surface.

Considerable diversity obtains in regard to the appearance of these tumors, depending, probably, not so much upon any peculiarity in their organization, as upon their age and the degree of irritation to which they are subjected. Thus, instead of being of a red, scarlet color, they are sometimes quite pale, grayish, spotted, or purple. Their surface is occasionally fissured, lobulated, or rough and granulated, like a strawberry, studded with small villousities, or covered with minute prominences, similar to those upon a suppurating wound. Their sensibility, although generally exquisite, is sometimes very slight, or almost null.

The growth of these excrescences is usually tardy. After they have attained a certain volume, they frequently advance in an imperceptible manner, or remain stationary altogether. Their origin is commonly insidious, and hence a considerable period often elapses before the patient is rendered aware of their existence, or before their true nature is suspected by the practitioner. Of their causes nothing whatever is known. They seem to be developed in the submucous cellular tissue, and, as already stated, they never attain a larger bulk than a cherry or a small horse-bean, whatever may be their age, or situation. They are not confined to any particular period of life, but are most common after the age of thirty-five or forty. They rarely, if ever, occur before the time of puberty. I have met with them, in one instance, in a girl of seventeen, and, in another, in a married woman of sixty-three.

The characteristic features of these tumors are, their florid complexion, their exquisite sensibility, their insidious origin, their slow development, and their small size. The suffering which attends them is often so great as to render the patient utterly miserable, and unfit for the ordinary duties of life. It is much increased by walking, the erect posture, sexual intercourse, and even the contact of the dress. The slightest touch, indeed, is commonly intolerable. The pain, which is frequently of a sharp, shooting character, ex-

tends, in many cases, into the pelvis, up the back, and down the thighs. From the situation of the morbid growths, micturition is mechanically obstructed; the stream of urine is sometimes reduced to the size of the smallest thread, and the evacuation of the fluid is accompanied with a hot scalding sensation, severe pain, and great straining. The bladder is excessively irritable, and there is almost a constant inclination to void its contents. Occasionally, the symptoms closely simulate those of stone, or cancer of the vagina. In the more aggravated forms of the affection, the general health is apt to suffer; symptoms of dyspepsia gradually show themselves; the stomach is weak and flatulent; the bowels are constipated; the urine is high-colored, scanty, and acid; the spirits are depressed; the patient is unable to move about, or take the slightest exercise, and the system is finally worn out by feverish excitement and loss of sleep. Little discharge attends these tumors, except when they are chafed or irritated by exercise, when they are liable to become inflamed, and to pour out a thin muco-purulent fluid.

From the account here given of these excrescences, there is little probability that they will be confounded with other morbid growths of the female urethra and its external orifice. The tumors for which they are most liable to be mistaken are the verrucous, from which, however, they may, in general, be easily distinguished by their history, the peculiarity of their situation, their florid appearance, their great sensibility, and the obscure nature of their origin. The verrucous excrescence is placed exterior to the urethra, upon the vestibule, is insensible, does not bleed when touched, and is of the same color as the surface from which it grows. It is always accompanied, moreover, by a mucous discharge, and is generally multiple. In malignant disease of the urethra the tumor is rough, fissured, or lobulated; hard and firm; comparatively free from pain, and of large size. Its growth is more rapid than the fleshy tumor of the urethra; and as it progresses it is liable to involve the lymphatic glands of the groin. The countenance also, in the latter stage of the affection, assumes the aspect peculiar to the cancerous cachexy. The polypoid tumor, although occupying the same situation, is easily distinguished from the vascular tumor by its larger size, its want of sensibility, its pale color, and its indisposition to bleed even when rudely touched. Like the vascular excrescence, it may obstruct the flow of urine, but it is never attended with the local and general distress which characterize the other growth. It need hardly be added that no opinion should ever be

given concerning any tumor in this part of the body without a thorough examination, both tactile and visual.

A case is mentioned, under the head of cystocele, where a tumor, formed by a prolapsion of the bladder, came very near being mistaken for a vascular excrescence. It happened in a child between two and three years of age; the swelling was about the size and shape of a walnut, with a rough, granular surface, not unlike that of a large strawberry. The professional attendant proposed to remove it with a ligature, which he was about to apply, when another surgeon, who was called into consultation, fortunately detected the true character of the disease, and thus saved the child's life.

Although these tumors are, in general, not dangerous, yet they may, by the protracted irritation to which they give rise, occasionally destroy life, or reduce the patient to the very verge of the grave. When extirpated, or removed by caustic or ligature, they are apt to return, and to acquire, in a short time, their original volume. Occasionally they assume a malignant tendency, and gradually degenerate into open sores, which manifest no disposition to heal, and which discharge a thin, foul, irritating ichor.

The *treatment* of this variety of tumor is strictly of a local character. Constitutional remedies, beyond their effect of improving the secretions and imparting tone to the system, are of no benefit. Attempts have been made from time to time to repress this morbid growth by astringent and sorbefacient applications, such as acetate of lead, Goulard's extract, tincture of iodine, and nitrate of silver; but without success. Instead, therefore, of wasting his time in this way, the surgeon should proceed at once to the employment of the only remedy known to be capable of affording permanent relief, namely, excision. This may be accomplished either with the knife or the scissors, according to the situation of the tumor. Seizure is effected with a small double hook, or a pair of broad-bladed forceps; the morbid growth is put gently on the stretch, or, if situated far back, carefully drawn forward, and then pared or snipped off with one stroke of the instrument, close to the mucous surface, or, if possible, so as to include a portion of this. Where this cannot be done, the surgeon waits till the bleeding has ceased, and then touches the cut surface with a stick of Vienna paste. The caustic is held for about a minute in contact with the part, which is immediately washed with a piece of soft sponge dipped in diluted vinegar, to prevent mischief to the surrounding textures. The object of this procedure is to destroy the deep-seated portion of the excrescence,

and, by modifying the capillary action of the part, to guard against its reproduction, which is otherwise almost certain to take place. Some surgeons employ, for this purpose, the caustic potash, but as this substance is liable to diffuse itself over the neighboring surface, it is better always to resort to the Vienna paste, which has little tendency of this sort. The same remark is applicable to the different acids, as the nitric and muriatic, as well as to the acid nitrate of mercury, so much vaunted, of late, in the treatment of excrescences of the genito-urinary organs.

When the excrescence is situated some distance within the urethra, it may become necessary, as a preliminary measure, to dilate the tube in the same manner as when the surgeon wishes to extract a urinary calculus. Such a proceeding, however, can seldom be called for, and should always, if possible, be avoided, on account of the danger of incontinence of urine.

When the excrescences are situated at the external meatus, or just within the urethra, and are so numerous as to form a kind of belt or zone around its circumference, the safest plan is to excise the affected portion of the tube, including the mucous membrane and submucous cellular tissue. The bleeding which follows the operation, and which is occasionally quite profuse, is readily stanch'd by pressure with a tent and compress wet with a strong solution of alum or gallic acid. Retention of urine sometimes ensues, and has to be met with the catheter.

The removal of these tumors is sometimes effected by ligature. The operation is both awkward and painful, and, worse than all, is seldom effectual, a portion of the excrescence being usually left behind, thus favoring repullulation. Should it be preferred, great care should be taken to apply the ligature as closely as possible to the base of the morbid growth, and to draw it with sufficient firmness to insure its speedy strangulation. Detachment usually takes place in three or four days. A practical precaution, of some consequence in using the ligature, is that it should not be too fine or delicate, nor drawn too tightly, otherwise it will cut through the tumor prematurely.

Any reproductive tendency that may manifest itself after these operations, should be counteracted by the nitrate of silver, or by a solution of this substance in nitric acid, by the muriated tincture of iron, or, what I prefer, by the tincture of iodine.

CHAPTER V.

MORBID SENSIBILITY OF THE URETHRA.

THE affection, which it is proposed to describe under this denomination, consists mainly, if not exclusively, in an exaltation of the natural sensibility of the mucous membrane of the urethra, similar to that which is so frequently witnessed in the throat, larynx, and urinary bladder. An analogous condition is often observed in strumous ophthalmia, the most distressing symptom of which is intolerance of light, and in certain diseases of the stomach, characterized by a sense of soreness and oppression, especially after eating and drinking, and by more or less tenderness on pressure of the epigastrium.

The disorder under consideration is quite frequent, and, from its obstinacy, often exceedingly annoying both to the patient and his attendant. Both sexes are liable to it, but it is much more common in men than in women; for the reason, doubtless, that the former are much more exposed to disease, both common and specific, of the canal than the latter, to say nothing of its greater length and of its more complex anatomical and physiological relations. The affection occasionally exists at a very early period, and is not unfrequently associated with the same complaint of the bladder.

Causes.—It is not always easy, or even possible, to ascertain the nature of the exciting causes of this affection, so diversified are they in their character. In the male it is often dependent upon the effects of gonorrhoea and gleet, stricture of the urethra, and enlargement of the prostate gland; and, in both sexes, upon disorder of the bladder, the kidneys, ureters, anus, and rectum. Ascarides and other worms, ulcers, abscesses, fistules, hemorrhoids, polypes, and malignant tumors frequently occasion it. Excessive venery, onanism, and nocturnal emissions may also be enumerated as so many exciting causes of the complaint. Morbid sensibility of the urethra sometimes attends inflammation, ulceration, and other disorders of the uterus, the vagina, and vulva. Vascular excrescences, whether situated within the tube, or clustered around the external meatus,

often produce similar effects. Lesions of innervation, dyspepsia, and morbid states of the urine may not only induce it, but maintain it for an indefinite period. The probability is that certain occupations predispose to its occurrence, as riding on horseback, constant sitting, and protracted standing. I have seen quite a number of cases of this kind in literary and hypochondriacal persons. Sometimes the origin of the complaint may be traced to the habitual use of certain articles of food and drink. Inebriates often suffer in this way. Of all the causes, however, onanism and inordinate sexual indulgence are, I have reason to believe, the most common.

Symptoms.—The symptoms of this affection are subject to great diversity, both as it respects their nature and degree. In the more simple forms, there is merely a slight exaltation of the normal sensibility of the mucous membrane, as evidenced by a sense of titillation, slight scalding in micturition, and a feeling of soreness along the lower surface of the penis during erection or copulation. When the affection is more fully developed, the local distress is not only more severe but more constant and diffused, often extending to the surrounding parts, as the perineum and anus, the groins, the pubes, and the genital organs, which are not unfrequently, in this event, the seat of dull, heavy, aching, or of sharp, darting pains, similar to those of neuralgia. The bladder is also liable to suffer, sometimes sympathetically, and at other times from a positive extension of the disease. The desire to micturate increases in frequency, and as the urine flows along the affected surface of the urethra it burns like fire or scalds like hot water. Occasionally the symptoms resemble those of stone in the bladder; there is great distress at the head of the penis, the patient is constantly pulling at the foreskin, and the stream of urine is often suddenly interrupted, as from some mechanical obstruction, although the real cause is spasm. When the disease exists in this aggravated form, there is always marked disorder of the general health; the appetite is deranged, the bowels are constipated, the countenance is haggard and woe-begone, the extremities are habitually cold, the body is easily impressed by atmospheric vicissitudes, the mind is peevish and fretful, and the slightest indiscretion in eating and drinking is sure to augment the local distress. Vague and indefinable sensations are experienced, not only in the urethra and in the rest of the genito-urinary apparatus, but in other regions and organs, and, as they always have a tendency to alarm the patient and absorb his attention, they are generally a source of real suffering. When the pos-

terior portion of the tube is involved, seminal emissions are apt to take place, and there is also frequently, in that case, an unusually abundant flow of prostatic mucus. When the affection is associated with gleet, there will commonly be a slight puriform discharge, or an appearance of little flakes resembling fragments of grains of boiled rice. The urine is variously altered in its properties; in general it contains an undue quantity of mucus, and not unfrequently it exhibits under the microscope different deposits, especially oxalate of lime and phosphates.

Hemorrhage occasionally attends this affection, but the occurrence, if I may judge from my own observation, is infrequent; nor is the loss of blood at any time abundant. A distinguished physician of North Carolina, who has long been a martyr to this complaint, informs me that he has had repeated attacks of this kind, some of which had lasted a number of days, before they finally yielded to treatment. He speaks of several other cases in which he has witnessed the same phenomenon. The blood sometimes comes away in a pure state, but more commonly it is mixed with the urine, to which it serves to impart a dirty, dingy, red appearance, which vanishes the moment the hemorrhage ceases. It is not always easy, in these attacks, to determine the seat of the bleeding, whether it is in the urethra, the bladder, the ureters, or the kidneys, as the diagnosis is generally obscure, if not altogether impracticable. In the case of my medical friend, the greatest amount of distress is in the prostatic portion of the urethra, but he also experiences much uneasiness in the bladder, penis, and sacro-lumbar region, where there is often a heavy, burning, or dragging sensation. Sometimes, his whole spine is tender; the genital organs are cold and numb; and there is often a feeling in the rectum, similar to what might be supposed to be caused by the presence of a large foreign body. His last attack of hemorrhage continued thirty-six hours, and was promptly relieved by gallic acid, in doses of three grains, repeated every three hours.

The symptoms of this complaint, it will thus be perceived, vary like the clouds; indeed, nothing could possibly be more erratic, irregular, or Protean. At one time, perhaps, the most prominent distress is in the testes and spermatic cords; at another, in the perineum and the anus; now in the bladder, or the urethra; now in the head of the penis and the prepuce; and now in the sacro-lumbar region, the chest, or the abdomen. The head usually comes in for a full share of the suffering, generally in the form of dull, heavy, aching pains,

dizziness, vertigo, throbbing in the temples, or a sense of constriction across the forehead. The sight is occasionally affected, or various fantastic objects dance before the eyes; and noises as of the ringing of a bell, the ticking of a watch, or the singing of an insect, often disturb the ear, constituting a sort of infernal music, which constantly reminds the poor sufferer of his sad and forlorn condition. The sleep is broken, and unrefreshing; palpitation of the heart is present; creeping, chilly sensations are felt along the spine, which is often quite tender under pressure; the legs and feet are subject to cramps; the gait is feeble and vacillating; frequent erections take place, and greatly aggravate the local distress; the genital organs are cold and numb, and occasionally there is a sense of itching, scalding, or burning around the fundament. In a word, the patient is a confirmed hypochondriac, a prey to his imagination and feelings, a being without any will or power of action; his reasoning faculties are weakened, his memory is impaired, he is utterly incapacitated for business and social intercourse, and despondency is depicted upon every feature of his countenance. His disease, real or imaginary, pursues him by day and by night; if he ascends into heaven, it is there, and if he goes into hell, it is there also. It is as a consuming fire; as a vulture incessantly gnawing his vitals. Such an affection is well entitled to the name of *urethrophobia*; for the subject of it is, to all intents and purposes, a monomaniac; the slightest change in his symptoms awakens the most horrible apprehensions, and the most trivial circumstance is sure to be magnified into an object of the greatest possible importance. The moment he sees, or fancies he sees, anything new in his case, he is seized with a mental spasm, and he immediately posts off to his medical adviser, to disclose the nature of his discovery, and to torment him with questions, alike silly, tedious, and irrelevant.

Diagnosis.—The best mode of determining the precise nature of this disorder is the introduction of the catheter. One of medium size is preferable to a very large or small one; it should be well oiled and warmed, and be passed along with the greatest care and gentleness, not rudely and rapidly, otherwise it will be sure to excite severe pain and spasm. Proceeding in this manner, the operator will be able to ascertain, with great satisfaction, both the extent and the degree of the morbid sensibility; whether, in a word, it is limited to a portion of the tube, or whether it is diffused over its whole length and breadth; whether it is slight or severe; and, finally, whether it is simple, or complicated with stricture of the

urethra, enlargement of the prostate gland, or disease of the bladder.

To form a correct estimate of the value of such an examination, the attendant should recollect that the introduction of the catheter, especially if performed for the first time, may, even in the healthy state, be productive of considerable uneasiness, if not of positive pain. Sometimes, indeed, the distress is so great as to induce swooning, or, at all events, a disposition to syncope, with severe prostration of the vital powers, as is indicated by the feebleness of the pulse, the pallor of the face, and the abundant sweats, together, perhaps, with the occurrence of rigors. The greatest amount of sensibility, in the normal state, commonly exists at the curve of the urethra, at the bulbo-membranous portion; a good deal is also generally found just behind the head of the penis; and occasionally it is very remarkable at the very commencement of the tube, as any one may satisfy himself by introducing a catheter. The edges of the meatus are often quite sensitive, especially when the orifice is unnaturally small and tight. The sensibility of the canal is greatest, other things being equal, in infancy, childhood, and adolescence, and least in old age. The frequent use of instruments, as the bougie and catheter, has a tendency gradually to diminish, and finally almost to destroy it. The same effect is sometimes produced by gonorrhœa and excessive venery; so that, instead of an increased sensibility, the urethra is so completely blunted that the patient is no longer capable of experiencing any voluptuous feelings, and coition, instead of being a source of enjoyment, becomes a cause of positive pain.

Pathology.—The true pathology of this disease is not accurately determined. There is no doubt that it is occasionally caused by inflammation, either subacute or chronic in its character; but very frequently it exists entirely independently of this lesion, and appears to be merely an exaltation of the normal sensibility of the mucous membrane, unaccompanied even by the slightest congestion of the capillary vessels. As was before stated, it bears the closest resemblance, in its essential features, to the morbid sensibility which is so common in the larynx and fauces, the stomach, the eye, and the urinary bladder, and the true nature of which is no better understood than that of the present affection.

Treatment.—The treatment of this affection cannot always be conducted upon strictly scientific principles, since, as already stated, it is often extremely difficult to determine its true character. In all

cases, it is a matter of paramount importance to inquire into the nature of the exciting cause, and the existence or absence of complications. If the cause be appreciable, or still in operation, it should, of course, if possible, be removed, otherwise no mode of management, however energetic or judicious, will be likely to afford any permanent benefit.

In general, marked relief will follow the use of antiphlogistics, especially if the disease be attended with an increased discharge of mucus, of puriform matter, or of pus, as will be apt to be the case when it has arisen from stricture of the urethra, gonorrhoea, or chronic enlargement of the prostate gland. If the patient be plethoric, blood may be taken from the arm, or by leeches from the perineum, the groins, and the antero-superior part of the thighs; the bowels should be well moved with mild but efficient purgatives; the diet should be bland and restricted; and free use should be made of the antimonial and saline mixture. The system having thus been reduced, the disease will usually promptly disappear under the use of bicarbonate of soda, either alone or in union with uva ursi and hop-tea, mild laxatives, and anodyne injections, with the addition of a small quantity of acetate of lead, Goulard's extract, sulphate of zinc, or nitrate of silver. When the patient is dyspeptic, or of a broken down constitution, a course of blue mass and ipecacuanha, tonics, and a generous diet may be necessary, along with cold bathing, the use of alkalies, and exercise in the open air.

The introduction of a full-sized catheter, at first once, and afterwards twice a day, will sometimes be productive of the best results. Of the beneficial effects of this treatment I might, if space permitted, adduce numerous cases. The pressure which the instrument exerts upon the walls of the tube soon blunts their sensibility and often acts like a charm in dislodging the disease. In this way, moreover, the affected surface may be directly medicated, by anointing the instrument with various unguents, especially the dilute ointment of the nitrate of mercury and belladonna, which is entitled to the first rank in the list of this class of remedial agents. When the morbid sensibility is connected with, or dependent upon, involuntary seminal emissions, hardly anything short of cauterization of the pre-tatic and membranous portions of the urethra will be likely to succeed. Sometimes, indeed, it is necessary to cauterize the tube in its whole length. When the disease proves very obstinate and intractable, a blister may be applied to the perineum, or, what is better, along the under surface of the urethra. Few cases will be

able to withstand this remedy. Whatever mode of treatment be adopted, the patient should carefully refrain from sexual indulgence and exercise on horseback; nor should he allow himself to become too easily discouraged if our efforts to relieve him are not speedily crowned with success.

CHAPTER VI.

NEURALGIA OF THE URETHRA.

It is not surprising that the excretory canal of the urine should be liable to neuralgia, especially when we consider its structure and functions, and the various sources of irritation to which it is subject. The disease occasionally exists at an early period of life, but is most common after the age of puberty, in young persons of a nervous, excitable temperament. Although it occurs in both sexes, it is much more frequent in males than in females, both because of the greater length and more complicated structure of the urethra in the former than in the latter, and because of their greater liability to all kinds of exposure.

The origin of this disease is generally obscure; sometimes it is traceable to external injury, as a bruise, or to the lodgement of a calculus; sometimes it manifestly depends upon the practice of onanism, or frequent sexual intercourse; now and then it follows an attack of gonorrhoea, orchitis, or disorder of the bladder, prostate gland, ureter, or kidney. In the Southwest, where this affection is not infrequent, it is often dependent upon a miasmatic impregnation of the system, and may, therefore, be said, under such circumstances, to have the same origin as intermittent fever. In the female, I have known neuralgia of the urethra to be connected with hysteria and dysmenorrhoea. In many cases, the disease is associated with neuralgia of other parts of the body, especially of the head, chest, and back.

Symptoms.—The manner in which this disease makes its appearance is variable; being sometimes sudden and unexpected, at other times gradual, and preceded by a sense of fatigue, soreness or uneasiness in the affected part. The pain is of a sharp, pricking character, darting about in different directions with the rapidity of lightning;

it often remits or even intermits for a few seconds, and then recurs with its former violence; it is generally attended with considerable soreness of the urethra and penis, a frequent desire to micturate, and more or less scalding in voiding the urine. Occasionally the disease is strictly periodical in its attacks, coming on at a particular time of the day, lasting an hour or two, and then gradually declining, to reappear about the same time the next day. In some cases, it assumes the tertian or quartan type. Distinct chilly sensations occasionally mark its access, especially when it is of miasmatic origin. The following case, one of many that have occurred in my practice, affords a good idea of the nature of this affection.

T. C. H., a student of medicine, twenty-six years of age, of temperate habits, and good constitution, was seized, on Saturday, the 12th of January, 1843, with a frequent and urgent desire to micturate, attended with a scalding sensation of the urethra, which was at the time entirely free from disease. Indeed, the patient had never had an attack of gonorrhoea, nor was he conscious that the parts had ever been injured in any way whatever. Although he had no difficulty in emptying his bladder, he found that voiding his urine neither relieved the desire to pass this fluid, nor to put a stop to the pain, which was of a darting, pricking character. Being in good health in other respects, he supposed that the symptoms would soon disappear, and therefore contented himself with a large dose of paregoric, under the influence of which he passed the night comfortably enough. In the morning the pain was gone; but, to his surprise, it returned late in the afternoon, and from that time on it assumed a periodical type, recurring regularly about the same hour every day. Thus it continued for a week. The general health, in the meanwhile, appeared to be excellent; the appetite was good, the urine retained its normal character, and all the functions seemed to be well executed. Satisfied, from a careful examination of the case, that the disease was neuralgia, I put the patient at once upon the use of quinine and arsenic, giving him four grains of the former with the tenth of a grain of the latter, every five hours. At bedtime he took blue mass and rhubarb in sufficient quantity to move his bowels. Under the influence of this treatment, aided by proper diet, the disease promptly lost its periodical character, and became, in every respect, mitigated. In ten days, the patient was so much relieved as to be able to go to the lecture-room, having still, however, a slight burning sensation in the urethra. Supposing that this

would disappear spontaneously, he discontinued his medicine, and resumed his accustomed mode of living. On the 6th of February, the pain returned with some severity, but not, as before, in regular paroxysms. The same prescription, with the addition of the sixteenth of a grain of strychnine, was ordered, and steadily persisted in until the 18th of the month, when all the symptoms had disappeared. To guard against relapse, the use of the medicine was resumed in five days, and continued for forty-eight hours, when it was finally laid aside: the cure being apparently complete.

Neuralgia of the urethra is often a troublesome and obstinate, though never a fatal, disease. I have known it to continue for years, not steadily but intermittingly, and finally to disappear quite suddenly, without any evident cause, or without any particular treatment. The disease is most apt to prove obstinate when it co-exists with neuralgia of other parts of the body, when it occurs in persons of a nervous, irritable temperament, or when it is associated with organic lesion of the genito-urinary apparatus.

Treatment.—The treatment of this affection is to be conducted upon the same principles as that of neuralgia in other parts of the body. The cause is, of course, first of all, to be inquired into, and, if possible, removed; then a searching cathartic is administered, containing a few grains of calomel, to clear out the bowels, and restore the secretions of the liver and the mucous follicles of the alimentary canal; and after this, recourse is had to the ordinary anti-neuralgic remedies, such as quinine, arsenic, strychnine, and aconite, variously combined, and persistently exhibited, their effects being duly watched, both by the patient and his attendant, for fear of over-dosing. When the affection is of a purely miasmatic origin, no other treatment is generally required; a few days suffice to mitigate the morbid action, and a few more to dispel it. In rare cases, long continuance of treatment is necessary, and, in all, care should be taken to guard against relapse. This object is best attained by making the patient take his anti-neuralgic remedies for two or three successive days every week; the bowels should not be neglected; the diet should be properly regulated; and the patient must avoid exposure to cold and wet. In the milder forms of the disease, quinine alone will often speedily effect a cure; but, in general, I combine with this substance some or all of the articles above mentioned. In obstinate cases, carbonate of iron sometimes succeeds when all other remedies fail; this medicine should be given in doses of from one to three drachms, three or four times a day, and should be

aided in its operation by the use of cathartics and alterants. Frequently patients affected with this disease are greatly benefited, and even entirely relieved, by a change of air.

Little is necessary in the way of local treatment. During the paroxysm, the penis may be immersed in warm water, or fomented with hot cloths, impregnated with laudanum; or, better still, the patient may use a hot bath, and an anodyne enema. These measures are particularly indicated when the pain extends to the neck of the bladder, or when the attack is attended with a frequent desire to micturate, a sense of scalding along the urethra, and great uneasiness in the head of the penis. The application of veratria and belladonna ointment is sometimes of service, in mitigating the local distress and re-establishing healthy action. In some cases I have witnessed good effects, especially in cold weather, from making the patient constantly carry his penis in a thick flannel stall, to protect it from atmospheric vicissitudes, which, as is well known, exert a most powerful influence over neuralgic diseases, in whatever part of the body occurring. The organ should be habitually elevated, and care be taken that the pantaloons do not exert any undue pressure upon it. It need scarcely be said that all sexual intercourse should be avoided.

CHAPTER VII.

HEMORRHAGE OF THE URETHRA.

HEMORRHAGE of the urethra, although not very common, is always alarming to the patient, and often a source of much embarrassment to the practitioner. It may present itself under two varieties of form, the spontaneous and the traumatic, of which the latter is by far the more frequent. When the mucous membrane is in a varicose condition, or abnormally soft and vascular, as it sometimes is in consequence of protracted congestion, the slightest cause is frequently sufficient to bring on a discharge of blood.—Under such circumstances, it is hardly possible to introduce a catheter, a bougie, or a sound without inducing some degree of bleeding.

Causes.—Spontaneous hemorrhage of the urethra is most common in old and middle-aged persons, who have led a life of irregularity and

debauch, and labor under habitual relaxation of the lining membrane of this tube. In such individuals, the slightest erection, straining at stool, or horseback exercise, is sufficient to bring on an attack. Frequently, indeed, it makes its appearance without any assignable cause whatever, perhaps while the patient is lying in bed, or walking about. I am occasionally in attendance upon a gentleman, about thirty-six years of age, who has had repeated eruptions of this kind, without having been able, in a solitary instance, to trace them to any particular agency. The discharge, in him, is usually of a dark modena color, small in quantity, and of short duration. Spontaneous hemorrhage here, as elsewhere, is generally the result of a process of exhalation. Occasionally, it may depend upon the rupture of a capillary vessel.

Traumatic hemorrhage of the urethra arises from various causes. Most frequently, it depends upon violence inflicted upon the tube by the passage or lodgement of a urinary concretion, the introduction of an instrument, as a catheter or bougie, or an attempt to force a stricture. It is a very common consequence of injury of the perineum; and it often follows the operation of cauterization. Hemorrhage of the urethra occasionally complicates the acute stage of gonorrhoea as the result of a rupture of some of the vessels of the lining membrane from chordee, or the act of coition. A frightful and even fatal hemorrhage has occasionally been produced by masturbation. It may also be caused by ulceration, or the presence of a chancre. A very interesting case of urethral hemorrhage, occurring immediately after sexual intercourse in a middle-aged gentleman, has been recently reported by Dr. Russell, of Boston.¹ The excitement was not greater than usual, and he had never before experienced such an effect. The quantity of blood lost was about a pint, and the patient remained quite feeble for several days, but without any signs of local irritation.

Quantity and Quality.—The quantity of the effused blood varies from a few drops to several ounces. Although it is generally greatest in cases of laceration and ulcerative perforation of the tube, it is sometimes not less abundant when it has its source in a slight abrasion of the lining membrane. The most abundant hemorrhages usually proceed from the posterior part of the urethra, probably on account of the greater vascularity there, both of the mucous tissue and of the surrounding structures. It is not often that the bleed-

¹ Amer. Journ. Med. Scien., Oct. 1850, p. 823.

ing, under any circumstances, is very copious, or that the blood issues rapidly, or in a full round stream. I have, however, seen several cases in which the hemorrhage was so great as to produce serious exhaustion, and where, if it had not been promptly arrested, it might have terminated fatally.

The color of the effused fluid varies from bright scarlet to black, or modena. In spontaneous hemorrhage, it is generally, at least according to my own experience, of a venous complexion; whereas, in the traumatic form, it is commonly of an arterial hue. Contact with the urine always renders it preternaturally dark.

When the hemorrhage is caused by violence, and has its source high up in the urethra, the blood may regurgitate into the bladder, where, from its contact with the urine, it soon coagulates, and often leads to retention. When, on the contrary, it has its rise in the anterior portion of the tube, the fluid generally escapes externally, either in a slow, trickling manner, or in a tolerably full stream. Sometimes the blood coagulates in the urethra, forming a long, cylindrical plug, accurately representing the size and shape of the canal, and of sufficient firmness to be pulled away without breaking.

Treatment.—Bleeding of the urethra seldom requires surgical interference; in most cases it ceases spontaneously, or is easily arrested by repose in the horizontal posture upon a hair mattress, iced drinks, and pressure, for a few minutes, upon the perineum, directly opposite to the part from which the blood proceeds. This may be made either with the finger, or by means of a twisted towel, rolled up, and applied firmly against the canal. In employing pressure, it is a matter of great moment that it be made properly, otherwise it will not only be useless, but decidedly injurious. It is not always easy to hit the precise spot from which the blood issues; hence the finger must be moved about from one part to another until the object is attained. If the pressure be applied in front of the seat of the hemorrhage, there is great probability that it will continue, and that the blood will pass back into the bladder, constituting thus a case of concealed hemorrhage, similar to that which is occasionally met with in the uterus. Such an occurrence might not only prove dangerous, but fatal. On the other hand, the pressure must not be made behind the affected part, for this proceeding, although not attended with the same risk, would be equally futile. The course which I generally pursue is, to place the finger upon the part from which the blood is supposed to proceed; holding it there for a few seconds, I ascertain whether it arrests the bleeding; if it do, I remove it, and apply it a

little farther back ; if the finger was upon the proper spot in the first instance, there will immediately be a recurrence of the hemorrhage, and the seat of the pressure is instantly changed accordingly.

A cold enema sometimes puts a sudden stop to this variety of hemorrhage ; and another excellent expedient is the application of pounded ice to the perineum, or the perineum and hypogastrium. Care, however, must be taken, in the use of the latter agent, that it be not continued too long, lest it produce chilliness, followed by violent reaction. Benefit may also be expected, in some cases, from injecting the urethra with cold water, or some astringent lotion, such as a solution of subacetate of lead, alum, gallic acid or creasote. The fluid should be thrown up as high as possible, in a full stream, and the operation should be continued for a considerable length of time, or until there is reason to believe that the relaxed or ruptured vessels are completely constricted.

When the case is obstinate, and the more ordinary remedies have failed, recourse must be had to compression from within outwards. This is always easily accomplished, except in cases of severe laceration, by means of a full-sized silver catheter, introduced into the bladder. The mere contact of the instrument frequently suffices to arrest the flow of blood ; but, should this not answer, counter-pressure is made with the finger, a bandage, adhesive strips, or, when the hemorrhage is deep-seated, with a compress and roller.

The best internal remedy in hemorrhage of the urethra, is gallic acid, in doses of from three to five grains every two or three hours. Where the case is urgent, it may be given more liberally, in combination with opium. Exhibited by itself, in large doses, it is apt to create nausea and vomiting, and to fail in producing the desired effect. In the spontaneous variety of this affection, gallic acid generally acts like a charm, completely arresting the flow of blood in a few hours. In the traumatic form, although not equally efficacious, it rarely fails to be of signal benefit.

Another excellent remedy in this affection, is the subacetate of lead in combination with opium ; three grains of the former with one of the latter should be given every three hours, and continued until the necessity for its exhibition ceases. Alum is another valuable agent in this affection. It should be administered in doses of from thirty to sixty grains every two or three hours. Employed in smaller quantity, little benefit is to be looked for. In very obstinate cases, there are perhaps no articles that hold out greater pros-

pect of success than spirits of turpentine and the muriated tincture of iron, in doses of ten drops each, repeated every hour. Both these medicines act specifically upon the urinary organs, and are particularly indicated in urethral hemorrhage occurring in weak, sickly individuals.

CHAPTER VIII.

FOREIGN BODIES IN THE URETHRA.

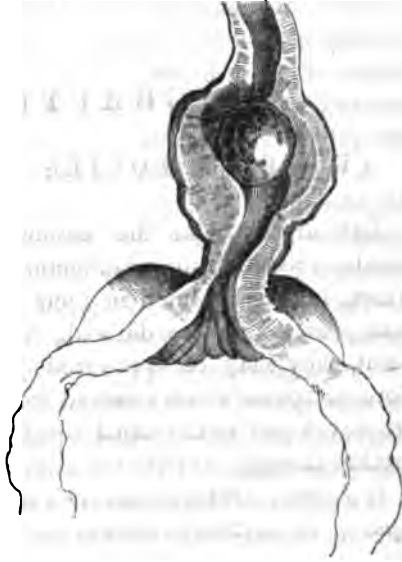
THE urethra, like the rectum, cesophagus, and other mucous canals, is liable to the introduction and lodgement of foreign bodies, which differ very much in their character, according to the source from which they are derived. Considered with reference to this point, they may be appropriately arranged under two heads: 1. Foreign bodies which descend from the urinary bladder, or which are developed in the canal itself. 2. Substances forced into the urethra through its external orifice.

1. *Foreign Bodies which Descend from the Bladder, or are Developed in the Urethra.*—Most of the foreign bodies which descend into the urethra from the bladder are simply earthy concretions, which are developed either in the latter organ, in the prostate gland, or in the kidneys. Sometimes, however, they consist of articles which were originally admitted through the urethra, and which have afterwards, in consequence of the force impressed upon them by the bladder or the stream of urine, taken a retrograde course. A bean, a bit of catheter, the end of a bougie, a needle, or a piece of wood, has sometimes met with such a fate. A ball, a pebble, a portion of wadding, or a fragment of bone, accidentally introduced into the bladder, may likewise pass from this organ into the urethra, and become impacted in it.

The concretions which descend from the bladder and lodge in the urethra (Fig. 176), vary much in regard to their volume, their shape, the character of their surface, and their chemical composition. It would require more time than can be allotted to the subject if I were to enter into the consideration of these different points; a circumstance which I regret the less, because it is really of little, if any, practical interest. The urethra being itself small, it rarely happens that the

concretion is more than three or four lines in its short diameter, although it may be twice, thrice, or even four times as large in the opposite direction. I extracted, not long ago, from the urethra of an old gentleman of sixty-seven, a calculus which was nearly one inch in length, while it was hardly three lines in thickness. When the passage is morbidly dilated, as it sometimes is behind a tight, callous stricture, it may admit a concretion of much greater volume. In its shape, the foreign body may be rounded, ovoidal, oblong, conical, angular, or curved. When it is perfectly straight, it will be more likely to enter the canal than when it is crooked; and its introduction will also be facilitated when the presenting extremity is comparatively small. Finally, the concretion may be perfectly smooth, partly smooth and partly rough, or rough and tuberculated in its entire extent. A smooth body will, all other circumstances being equal, enter and pass the urethra with greater ease and less pain than a rough one. The foreign substance may be prevented from escaping by a stricture.

Fig. 176.



Secondly, the concretion may be developed in the urethra itself. The occurrence is rare; but that it is possible is shown by the fact that a foreign body, such as a piece of straw or a bit of bougie, lodged in this tube, has sometimes become speedily incrustated with sabulous matter, and that calculi have occasionally formed in a perineal fistule, the scrotum, and the prepuce. The development is favored by the existence of an abnormal pouch of the urethra, or by an organic stricture attended with dilatation and ulceration of the canal behind the obstruction. The concretions do not seem to differ, in any essential particular, as it respects their physical and chemical properties, from those which form in the bladder and

kidneys. They are usually diminutive; and they vary in their number from one to five or six.

A very extraordinary example of calculus of the urethra is mentioned by my distinguished friend, Professor Mütter, of Philadelphia, in his Notes to Liston's *Operations of Surgery*. The patient was a young man of twenty, of very feeble health, and with evidence of chronic inflammation of the bladder. The concretion, which was immovably fixed in its situation, hard, smooth, and about the diameter of an ordinary pipe-stem, was accurately moulded to the urethra, and reached from within an inch of the external orifice of the tube to the neck of the bladder.

A urinary concretion, or any other foreign body forced from the bladder into the urethra, may lodge in any portion of this tube, from its commencement to its termination, and the symptoms awakened by its presence will not vary essentially whatever may be the part affected. When the substance is permanently fixed, it generally attains a greater magnitude in the membranous division of the canal than in any other, simply because this portion of the tube is naturally very dilatable. Sometimes, however, large concretions form at the prostatic portion, the sinus of the bulb, and the navicular fossa.

Symptoms.—The passage of a calculus from the bladder along the urethra is frequently productive of great inconvenience and distress. The intromission is generally sudden and unexpected, taking place while the patient is engaged in micturition. It is instantly followed by an interruption of the stream of urine, an urgent desire to empty the bladder, severe straining, more or less pain, and a sense of burning or tearing in the urethra. If the substance is small, it may be expelled in a few minutes, perhaps during a new effort at micturition followed by immediate and permanent relief. If, on the contrary, it is disproportionably bulky, it may be arrested for several hours or even days, and give rise to severe suffering, accompanied by partial or complete retention of urine, painful erections, and probably also by slight hemorrhage from laceration of the mucous membrane. When the calculus is of extraordinary size, it can hardly fail to lodge permanently, and to lead to all the distress, both local and constitutional, which is always sure to result from the protracted obstruction of an important excretory tube.

The symptoms which attend the passage of a calculus along the urethra may be simulated by those produced by other causes, and

are, therefore, of no positive value in determining the nature of the accident. To establish the diagnosis, it is necessary to institute a careful examination with the finger and the catheter. When the foreign body occupies the spongy portion of the urethra, the finger, applied to the lower surface of the penis, will generally readily detect it, and give the surgeon a correct idea both of its volume and configuration. The same means will enable him to ascertain whether it is fixed or movable. When the substance is situated farther back, as in the membranous or prostatic portion, the exploration must be conducted with the finger in the rectum, otherwise, especially if it be very small, it will be impossible to feel it, on account of the great thickness of the soft parts.

When the foreign body cannot be detected with the finger, or where any doubt remains respecting the real nature of the obstruction, recourse must be had to the catheter. The best instrument, for this purpose, is a silver one, well rounded at the vesical extremity, and of medium size. This is introduced in the usual manner, and carried on towards the bladder as slowly and as gently as possible. If the obstruction has been caused by the presence of a calculus, the contact of the catheter with the foreign body will produce a peculiar sound and a rubbing or grating sensation, which no one, practised in such examinations, can mistake. The diagnosis is established. Some idea may be obtained concerning the volume of the concretion by observing whether the instrument is completely arrested by it, or whether it slips between it and the walls of the urethra. In making this exploration, care should be taken, by inserting the finger into the rectum, that the foreign substance be not pushed back into the bladder; an occurrence always to be deprecated, unless it is rendered absolutely necessary in consequence of retention of urine, or the want of proper instruments for performing extraction. It is worthy of remark, that, when the calculus has escaped from the urethra and lodged in the subjacent structures, the instrument may fail to detect it, even when it is of large size.

When a calculous concretion has been developed in the urethra, or has been forced into it from the bladder and retained there for a long time, its tendency is to increase, by the addition of new deposits from the earthy salts of the urine. The extent to which this augmentation may reach is variable, as are also the effects to which it may lead, as it respects the surrounding tissues. A concretion, weighing five or six ounces, has occasionally been developed

in this situation, and given rise to all the symptoms of vesical calculus. Long before it attains such a bulk, the foreign substance, producing ulcerative absorption, leaves the canal of the urethra, and forms a sort of cul-de-sac by the expansion, thickening, and condensation of the circumjacent structures. It has been supposed that this secondary receptacle is produced simply by a dilatation of the canal, in consequence of the continued pressure of the foreign substance; but if this be the case, it can only be true of the disease in its earlier stages, for it is hardly possible to imagine that a tube, so small as the urethra, could, under any circumstances, increase so much in size as to accommodate a stone of the weight above mentioned.

During a visit which I made several years ago to Philadelphia, Dr. Peace, a distinguished surgeon of that city, had the kindness to give me the particulars of the following very interesting case of urethral calculus, which he relieved by operation. The patient, Daniel McMenony, aged twelve years, was admitted into the Pennsylvania Hospital, on the 10th of August, 1842, for a swelling of the scrotum produced by the kick of a cow. In the course of a week all the symptoms of inflammation had disappeared, and a large tumor was found under the scrotum. A sound was introduced, and a stone was immediately detected. The boy stated that he had been cut, for stone, two years ago, by Dr. Randolph, and that he had remained well for three months, when he began to observe some difficulty in urinating, attended with a swelling within the scrotum, and some degree of pain, especially at the close of micturition. An incision was made immediately behind the scrotum, and a calculus, weighing four ounces, was exposed, broken, and removed with the scoop and forceps. No bad effects followed the operation. In a few days a small stone was detected in the bladder, from which it was removed subsequently, at three sittings, by means of Heurteloup's instrument. The opening made in the urethra became fistulous, and a catheter was passed with some difficulty into the bladder, but could not be retained on account of exciting erysipelas. The patient was afterwards sent into the country to recruit his health, and did not again apply for admission.

A calculus, permanently impacted in the neck of the bladder, has been known to cause complete absorption of the prostate gland, and great dilatation of the corresponding portion of the urethra. The foreign body, in this case, being situated partly in the bladder, and partly in the urethra, sometimes attains an extraordinary volume,

and presents a most fantastic appearance, especially when it extends several inches into the latter tube. The symptoms are those of ordinary vesical calculus, except that there is not so much interruption to the stream of urine, because of the immovable condition of the concretion, and because of there being also, for the same reason, more frequently incontinence, in consequence of the loss of power of the sphincter muscle.

Finally, a calculus, after having remained in the urethra for an indefinite period, sometimes effects its own expulsion. This it does by exciting absorption of the surrounding parts, which gradually progresses until all the tissues give way, save, perhaps, the cutaneous, which at length yields under a violent effort at micturition. Or, instead of this, the skin ulcerates at the most prominent portion of the tumor, and exposes the foreign body to such an extent as that it may be easily extracted.

Treatment.—The treatment of urethral calculi must necessarily be influenced by a variety of circumstances, some of which hardly admit of precise detail. When the foreign body is lodged in the posterior portion of the tube, and is so large as to obstruct the flow of urine, the safest plan is to push it back into the bladder, whence it came. For this purpose a full-sized silver catheter, with a blunt extremity and a small curve, is used; this is introduced in the usual manner, and then gently but firmly pressed against the concretion, at the same time that the finger is applied upon the perineum, to prevent the formation of a false passage. A small instrument is unsuitable, inasmuch as its point might pass between the calculus and the wall of the urethra. Any spasmodic action that may exist, whether in the tube itself, or in the muscles by which it is surrounded, should be combated by venesection, tartar emetic, the hot bath, and anodyne enemata; or, what is better than all, by the exhibition of chloroform. Unless the concretion is very bulky, rough, or curved, this plan will seldom fail, and should always, I conceive, be preferred to the more uncertain method of extraction.

If, on the contrary, the extraneous body is comparatively small, or so irregular on the surface as to enable the patient to void his urine, it should not be pushed back but removed. Delay here is of little consequence, as the accident is rarely attended with much suffering, and the surgeon has ample time to prepare for the operation. Before resorting to extraction, an attempt should be made to favor the expulsion of the concretion, by dilating the portion of the urethra which is in front of it, by means of the catheter or bougie.

This process has been successful in more instances than one. Occasionally extrusion may be effected by injections of sweet oil, or by closing the prepuce, and holding it tightly while the patient is making a powerful effort to expel his urine, at the same time that pressure is applied along the under surface of the urethra, to urge on the foreign body.

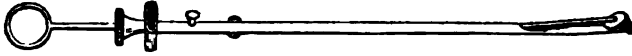
When the calculus occupies the spongy portion of the tube, it is clear enough that it ought to be extracted, whatever may be its size or form. To push it back into the bladder would be difficult and hazardous, on account of the distance at which it is situated, and the curved direction of the canal, to say nothing of the violent spasm which such an attempt is calculated to awaken in the perineal muscles.

Extraction.—When the foreign body, whatever be its situation, is so firmly impacted that it can neither be expelled by the powers of the patient, nor pushed back into the bladder, extraction is necessary. This may generally be effected when the concretion is near the orifice of the urethra, or in that portion of it which corresponds with the head of the penis, by very simple means, as a pair of narrow-bladed dissecting forceps, or even the fingers; but the reverse is often the case when it is lodged far back in the canal. One of the most simple contrivances for effecting our object, under such circumstances, is the wire-loop, originally suggested by Marini. This consists, as the name implies, of a piece of smooth, thin, flexible wire, of silver or copper, bent like a hair-pin, the convex extremity of which is passed down the urethra, and insinuated behind the foreign body, which is then caught and drawn out. A modification of this instrument, if so it deserves to be styled, was made by Julius Cloquet, by adapting to it a silver canula with a side-screw, in order the more effectually to secure the calculus after it has been seized by the wire. The objection to this instrument, in both its forms, is the difficulty of passing it behind the concretion, which, when large enough to lodge, usually fills up the entire passage.

When these simple means fail, and also in the more difficult forms of the accident, recourse must be had to the urethral forceps, of which a great variety have been devised by surgeons. Of these, the most useful and important are those of Sir Astley Cooper, Civiale, Amussat, Leroy d'Etiolles, and Bonnet, which are all constructed upon the same principles, though they differ from each other in their form and mode of arrangement. Several of these

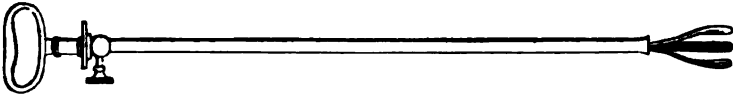
instruments are represented in the annexed drawings, which preclude the necessity of any labored description. The one to which I give the preference, both on account of its simplicity and its happy adaptation to the end proposed, is the articulated scoop of

Fig. 177.



Bonnet, of Lyons; it is armed with a stylet, and is furnished with a head for seizing and fixing the foreign body. The instrument, well oiled, is introduced shut, until it comes in contact with the concretion, when its blades are expanded over it; the extraction being effected in the most slow and gentle manner, to prevent in-

Fig. 178.



jury of the mucous membrane. Fig. 178 represents Hunter's forceps, as improved by modern surgeons.

Lithotripsy.—Breaking or crushing is applicable only when the calculus is soft or friable; but as this can hardly ever be known beforehand, it is seldom available. The operation, moreover, is seldom safe, however carefully performed, being liable to be followed by laceration of the mucous membrane, infiltration of urine, and severe inflammation. It may be done with a straight sound or silver catheter, well rounded at the point, care being taken to steady the concretion with the thumb and finger, to prevent it from receding. The fragments are afterwards washed out by the stream of urine, which should always be retained for several hours previously to the operation. Leroy uses an instrument, called the spoon-shaped stone-crusher. It is very similar to Civiale's instrument for breaking vesical calculi. Urethral lithotripsy ought seldom to be resorted to, except when the concretion is situated in the spongy portion of the tube, and is of the consistence above mentioned. When it is lodged far back, the operation is difficult and hazardous.

In the remarkable case of Dr. Mütter, previously referred to, that gentleman succeeded in freeing the urethra by cutting off daily a piece of the stone, with a pair of small, strong, slightly curved,

sharp-cutting forceps, expressly constructed for the purpose. As the urethra was very irritable, the operation was attended with some pain, but nothing serious ensued, and in a short time the entire cylinder was removed.

Excision.—This operation, which becomes necessary when extraction fails, varies according to the situation of the foreign body. When the concretion is lodged deeply, as in the prostatic or membranous part of the tube, it is performed very much after the manner of Celsus, in cutting on the gripe, as it was called. The rectum having been thoroughly emptied by an enema, and the patient placed as in the operation of lithotomy, the surgeon introduces the fore and middle fingers of the left hand, well oiled, into the anus, and uses them to push the stone forward, to make it protrude and form a tumor in the perineum. An incision is then made, either of a lunated shape, as in the bilateral method, or, what is better, because more easy and simple, obliquely downwards and outwards, as in the ordinary operation; first through the skin and cellular substance, then through the muscles, and finally through the urethra. A small opening will generally suffice. When the concretion is fully exposed, it may either be pressed out with the fingers, or extracted with a blunt-hook or pair of forceps. In performing this operation, care must be taken to guard the rectum.

When the calculus is impacted in the navicular fossa, its removal is easily effected by incising the lower part of the urethra where this tube corresponds with the head of the penis. The operation may be performed with a narrow, probe-pointed bistoury, or a cataract-knife.

The operation is also very simple when the concretion is lodged in the membranous portion of the tube. The skin being carefully tightened by an assistant, the surgeon, armed with a scalpel or bistoury, divides the parts with one stroke of his instrument along the median line at the inferior surface of the penis. The calculus being removed, a silver catheter is introduced into the bladder, and the edges of the wound are brought together by several points of the interrupted suture. When the foreign body lies in that portion of the urethra which corresponds with the scrotum, incision should be practised with great caution, from the fact that it is liable to be followed by infiltration of urine and all the bad consequences of this accident. In such a case, I would advise immediate cauterization of the wound with nitrate of silver, to favor the deposit of lymph, and an avoidance of micturition for ten or twelve hours, or

until the parts have become fully consolidated; or, what would be preferable, an incision might be made through the skin and cellular tissue over the tumor, and the wound stuffed with lint. The requisite amount of inflammation having been excited, the operation is completed by dividing the parietes of the urethra in the usual manner. In this way the bad results in question might be effectually avoided.

2. *Foreign Bodies Introduced from Without.*—Of foreign bodies introduced into the urethra from without, the number and variety are quite considerable. Indeed, a volume might be written upon the subject without exhausting it. The occurrence is sometimes fortuitous, or the result of accident; but, more frequently, it takes place through design, either of the patient himself, or of mischievous and wicked persons, who take advantage of the helpless state of their intended victim. Bits of catheters, bougies, quills, pipe-stems, wood, straw, and other substances have been accidentally lodged in the urethra by individuals endeavoring to draw off their urine, relieve a stricture, or provoke onanism. Females, apparently from mere wantonness, or a desire to excite sympathy and commiseration, often introduce pebbles, cherry-stones, chicken-bones, pins, needles, and other articles, into the urethra. Morand cites the case of a girl of twenty, who had inserted a toothpick into this passage, from which it soon slipped into the bladder, from which it was finally extracted by an operation. Pamard mentions an instance in which the foreign substance was an ivory whistle, three inches and a half long, and five lines in diameter at its centre. Rigal was obliged to remove from the bladder of a young female a wooden needlecase, which had passed into the urethra in masturbating. Morgagni asserts that it was by no means uncommon, in his day, in Italy, for lascivious girls to introduce into this canal the golden pins worn in their hair.

In the pathological museum of the New York Hospital is a glass jar marked 92, which is nearly filled with pieces of burnt brick, which were removed, at different times, by Dr. Stevens and other surgeons, from the bladder of a woman, who was in the habit of introducing them, apparently for the purpose of rendering herself an object of interest and commiseration. Dr. Lente, one of the resident surgeons of the institution, has done me the favor to examine these pieces, and to communicate to me the result of his observations. Some of them are tolerably smooth, having evidently been made so by scraping, while others are quite rough and

irregular. Only sixty-seven pieces, or about one-third of the entire number, are preserved. In their shape, some are cylindrical, others fusiform; the ends of the latter, however, taper but little, and are round and abrupt. Many of them are slightly curved, the patient having probably discovered, by constant practice, that this was the most convenient form for their easy introduction. The largest concretion is two inches and a third in length, by two inches and a third in circumference at its widest part; the smallest, on the contrary, is only fifteen lines in length, and eight lines in circumference. In their weight, they vary from a drachm to half an ounce.

Bodies similar to the above are sometimes forced up the urethra of the male. Soulé has recently published the case of a young man of twenty-three, from whose urethra he removed a hair-pin; Fardeau saw an individual from whom he extracted an iron wire, upwards of seven inches long, one end of which had pierced the tube, and become fixed in the inner edge of the tuberosity of the ischium; and Lallemand operated upon a patient, aged fifty years, who had a sail-maker's needle, four inches long, in his urethra. Civiale extracted from the bladder of a man, by means of lithotrity, a bean, which had been introduced through the urethra eleven months previously, and which gave rise to all the symptoms of stone.¹ I shall have occasion presently to revert to some of these cases. Dr. James R. Wood, of New York, showed me, several years ago, a pewter spoon-handle, five inches in length, which he removed from the urethra of an old man of seventy-two, who had been in the habit of using it for producing artificial excitement. One evening it slipped out of his fingers, and passed beyond his reach. Dr. Wood introduced a catheter, but found he could get it no further than the junction of the bulbous and membranous portions of the tube. To prevent the foreign body from passing completely into the bladder, he fixed it with his finger in the rectum, and then extracted it with the urethra forceps.

In another case, for the particulars of which I am indebted to the same gentleman, the foreign body was a piece of leather, eighteen inches long, and about the size of a No. 7 catheter. The patient was a man forty-five years of age, who, while practising onanism, by means of this substance, found himself unable to withdraw it, although he used great exertion so to do. When Dr. Wood saw

¹ Deslandes on Manhood, p. 181. Boston, 1845.

him, soon after the accident, four inches of the string were seen to protrude at the external orifice; while the other end, rolled up into a large and firm knot by the patient's manipulations, was discovered in the bladder by the finger in the rectum. By great and steady traction upon the free extremity of the foreign body, maintained for fifteen minutes, aided by division of the meatus, to allow the knot to pass, he finally succeeded in extracting it. The annexed drawing, Fig. 179, is an accurate representation of the vesical extremity of the string with its knot.

Fig. 179.



In the *Transylvania Medical Journal* for October, 1850, is an account, by Dr. W. H. Shotridge,¹ of Kentucky, of a very singular case in which the lodgement of a *hair* in the urethra caused severe inflammation of that tube, along with an irritable condition of the bladder and other unpleasant symptoms. The following are the principal particulars of it:—

CASE.—A married gentleman, about fifty years old, of irreproachable character, was seized with a tickling, itching sensation in the fore part of the canal, which, after having continued for three months, became much aggravated. The anterior third of the penis now began to swell, and to be red and painful, and there was a frequent desire to urinate, with difficulty in emptying the bladder. Febrile symptoms supervened; the inclination to micturate increased; and there was a slight discharge of pus, and, at times, also of blood, from the urethra. About four days after this, on examining the parts, the patient discovered a hair hanging from the orifice of the canal, and, on pulling it out, it was found to be nineteen inches in length. There was some chordee for a short time before the foreign body was removed, and for a few days afterwards the symptoms closely resembled those of gonorrhœa. The gentleman gradually recovered, but not without the aid of constitutional treatment. It would seem that he had suffered from a similar attack about fifteen years before, but that the hair was shorter, and there was no inflammation of the urethra.

Was the hair, which gave rise to the symptoms here described, generated in the urinary organs, or was it entangled by the penis, and gradually drawn into the urethra by the intractive force of that tube? However this may be, the fact is one of much practical interest, and is, therefore, worthy of being recorded.

¹ See the author's Report on Kentucky Surgery, p. 116. Louisville, 1853.

Foreign bodies, introduced from without, produce various effects, according to the manner in which they are inserted, their nature, the distance which they have travelled, and the period of their sojourn. There is one feature which they all possess in common, namely, a remarkable propensity to migrate to the bladder, no matter what may be their form, size, or composition. The bladder manifests, so to speak, in all cases of this kind, a disposition to swallow the foreign body, or to suck it in. In what manner this is effected has not been satisfactorily explained. It is probable that it is produced by one of three circumstances, either by a sort of peristaltic action of the tube, by suction of the bladder, or, what is more plausible, by capillary attraction. Be this as it may, the manner in which it happens does not affect the fact, a knowledge of which is quite sufficient for all practical purposes.

In some cases the extraneous substance becomes impacted, and remains in the tube for an indefinite period, perhaps for many years, attended, it may be, with little inconvenience or functional disturbance. Occasionally, it forms the nucleus of a urinary concretion, or its surface becomes incrustated with earthy matter. When bulky, it gives rise to retention of urine, with inflammation of the urethra, severe pain, morbid erections, frequent micturition, rigors, and high constitutional disorder. Hemorrhage is liable to attend when the foreign substance has an unusually rough surface, or when it has been rudely inserted.

Finally, it occasionally happens, as was previously stated, that the escape of a concretion is prevented by an organic stricture. When the case is urgent, or admits of no delay, in consequence of retention of the urine, relief must be afforded either by dividing the stricture with the lancetted stylet, and then extracting the calculus in the usual manner, or, when this is impracticable, by making an incision into the tube, embracing both the stricture and the foreign body.

Much tact and ingenuity are often required in extracting a foreign body introduced from without. This is especially the case when it has broken off low down in the passage, or when it has pierced its walls. Much difficulty may also result from the peculiar nature or shape of the article. Thus, a hair-pin, inserted head foremost, and pushed out of sight, might greatly perplex, and completely baffle, a man unaccustomed to think for himself, or rely upon his own resources. Boinet, a French surgeon, being called to a case of this kind, had recourse to the following ingenious expedient: Taking hold of the penis, he bent this organ strongly upwards, at the same

time that he made firm pressure upon the head of the pin, to prevent it from receding. By this manoeuvre the points of the instrument were forced through the lower wall of the urethra; the two branches were then separated transversely, when one of them was cut off, and the other pulled out. The operation lasted only a few minutes, and was not followed by any unpleasant effects. This expedient was recently employed with complete success by Soulé of France. A young man, twenty-three years of age, had introduced a hair-pin, head foremost, into his urethra, the ends of the branches being about one inch from the meatus, and consequently entirely out of sight. Every attempt was made to extract the foreign body through that aperture, but in vain. He then had recourse to Boinet's process, and accomplished his object in a few minutes.

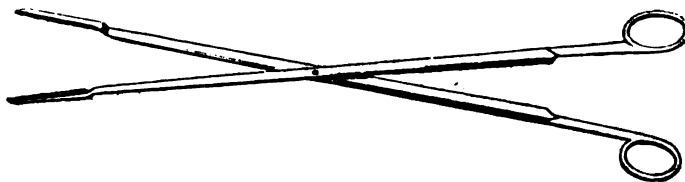
I have already alluded to the case reported by Fardeau of a young man who introduced into his urethra, for the purpose of titillating it, an iron wire upwards of seven inches in length. The end of the wire was bent into a hook, probably to excite more vivid sensations. One day, while indulging in this strange operation, he suddenly felt a severe pain, which proved to have been caused by a laceration of the membranous portion of the canal. In his attempts to withdraw the wire, the unfortunate man only forced the hook further into the soft parts. He then rounded the projecting part of the iron into a ring, hoping thus to be able to extract it the more easily. Finding all his efforts fruitless, and expecting every moment to die, he sent for Dr. Fardeau. The penis and scrotum were enormously swollen, hot, and painful; the bladder was unable to expel its contents; and the patient had high fever with incipient delirium. Grasping the loose portion of the wire, Dr. Fardeau soon found, to his astonishment, that the end was immovably fixed in the inner edge of the tuberosity of the ischium. An oblong incision being made over this part, the hook was seized, and the wire was withdrawn through the perineum. The patient was completely restored.¹

When the foreign substance is of a simple character, as the stalk of a plant, a toothpick, or a pin, it may, if it have not slipped too far back, be extracted with a pair of delicate forceps, as those represented at Fig. 180. To render the success more certain, the penis should be held horizontally, and slightly on the stretch, otherwise it may be difficult to expand the blades of the instrument over the extremity of the intruder. Care should also be taken that the

¹ Deslandes on Manhood, p. 129. Bost. 1845.

forceps do not pass between the substance and the wall of the urethra. Another precaution, not to be overlooked, is to apply pres-

Fig. 180.



sure just behind the foreign body, to prevent it from receding during the attempts at extraction. When the extraneous substance is a

bit of bougie, it may sometimes be extracted with an instrument like that represented in Fig. 181, and the extremity of which is shaped somewhat like a screw. When the operation fails, it will be proper, as a dernier resort, to cut down upon it through the walls of the tube, and remove it with the forceps. A small opening, barely large enough to expose the anterior extremity of the impacted body, will suffice. A common needle might be extracted after the method of Boinet, described above; a pebble, bean, or seed-stone, with the forceps employed for removing urethral calculi.

Mons. Vidal¹ had the good luck, some years ago, to extract a pin from the urethra of a child six years of age, by means of a curved catheter. The foreign body had been lodged in the posterior part of the tube for twelve days, and had occasioned severe suffering. The instrument was introduced with the convexity towards the pubic symphysis, as far as the bulb, when, instead of being pushed on into the bladder, he turned it round, as in the operation of the *tour de maître*, and suddenly withdrew it from the passage. To his surprise, he found the pin lying in the eye of the catheter.

A case, similar to the above, occurred not long ago, in the practice of Dr. Raynaud, of Montauban.² A child, eight years old, introduced a needle, head foremost, into the urethra, through which it descended as far as the prostatic portion, causing severe pain in the perineum and anus. An assistant having inserted his finger into the rectum, to prevent the needle from passing further back, a

¹ Pathologie Externe, t. v. p. 109. Deux. edit.

² Annuaire de Méd. et de Chirurg. Pratique, 1847, p. 119.

large silver catheter was carried down to the foreign body, which, while strong pressure was made upon the posterior part of the tube with the finger, was gradually and gently dragged by the instrument into the navicular fossa, from which it was afterwards easily extracted with the forceps.

The above cases must be regarded as examples rather of good luck than of any particular skill in the operators. The operation might be repeated a hundred times, even by Vidal and Raynaud themselves, without success.

Calculi in the Prepuce.—As an appendix to the preceding topics a few remarks may be introduced here on calculi of the prepuce. The subject is of sufficient importance to deserve a passing notice in a work of this kind.

It has long been known that urinary concretions are liable to form in this situation, where, from the irritation induced by their presence, they often become a source of much suffering. The disease can, of course, occur only in persons in whom this covering is unusually long and tight, and where, consequently, it offers great impediment to the evacuation of the urine. When this is the case, more or less of this fluid is habitually retained in the abnormal pouch thus formed, where it deposits its salts just as it does under certain circumstances in the urinary bladder. The disorder sometimes appears at a very early age, and may, from neglect and other causes, attain an extraordinary development.

Preputial calculi do not differ in their chemical and physical properties from concretions of the bladder. They generally consist of lithic acid, or of urate of ammonia, and occasionally, though rarely, of phosphate of lime, either alone or in union with magnesia. Their volume and number are sometimes remarkable. Thus, in a case observed by Dr. Schwartz,¹ of Germany, the concretion, which was of a rounded form, and weighed nearly five drachms, was upwards of three inches and a half in circumference. Sabatier refers to a stone of this kind which weighed upwards of three ounces, and Duméril saw one which weighed between seven and eight ounces. In a foreign medical periodical, *Memorie dall' Institute Lombardo-Veniziano*, for 1827, an instance is briefly narrated, in which the prepuce of a man laboring under phymosis contained one hundred and six calculi. Occasionally the matter exhibits itself in the form

¹ Rust and Casper's Repertorium der Gesamnte Heilkunde, B. xix. S. 881. Berlin, 1828.

of sand or gravel; and examples occur in which the two varieties of deposit coexist.

The affection of the prepuce leading to the formation of this disorder, may be congenital, or accidental, the result, for example, of gonorrhoea, chancre, or external injury. However induced, the membrane is gradually dilated into a large pouch, capable of holding several ounces of fluid, of an irregular, unseemly form, hard at some points, and soft, perhaps fluctuating, at others, tender, heavy, and occasionally very painful. The orifice is commonly very narrow, and hence there is always much trouble in voiding the urine, which often comes away in drops. In some instances there is retention of urine, from paralysis of the bladder, dependant upon the protracted preputial obstruction; the parts are swollen and distorted, and the general health greatly suffers, the patient being nervous, irritable, and dyspeptic. In a case reported by Mr. D. M. Dickson,¹ the patient, a sailor, aged twenty-two, the tumor was of the size of a goose's egg, and contained eight ounces of urine. Its orifice was often entirely obstructed, and the man was for a long time in the habit of piercing the skin with a piece of pointed wood, to enable him to void his urine; the aperture generally closing after each operation, and thus requiring to be constantly re-opened.

The treatment of this affection, in whatever form it may exhibit itself, is obvious and simple. The cause of the difficulty being entirely mechanical, it is only necessary to retrench the elongated prepuce and clear out the contents of the sac, formed by the retention of the urine. The operation, in short, is the same as that for ordinary phymosis, and does not, therefore, demand any special notice in a work of this kind.

CHAPTER IX.

HETEROLOGOUS FORMATIONS OF THE URETHRA.

THE urethra, like the urinary bladder, is liable to what are denominated the heterologous formations, as scirrhus, encephaloid, and tubercle. These affections, however, are extremely rare, espe-

¹ Duncan's Annals of Medicine for 1799, vol. iv.

cially as independent deposits, and their occurrence here is interesting rather in a pathological than a practical point of view. Of colloid and melanosis of this tube we are entirely ignorant.

Scirrhus of this tube has been observed only a few times as an independent disease; indeed, it is extremely rare in any form. One of the best examples with which I am acquainted of hard cancer originating in the male urethra, is that recorded by Mons. Lallemand.¹ The deposit existed as an isolated tumor, of the size of a hazelnut, and of a lardaceous consistence, at the posterior surface of the canal, behind the bulb. A similar disease occupied the bladder, but the two were separated from each other by healthy mucous membrane, and the former could not, therefore, be regarded as a prolongation of the latter. In scirrhus of the neck of the bladder and the prostate gland, the morbid deposit, especially in its more advanced stages, is occasionally extended some distance along the urethra.

Encephaloid of the male urethra has occasionally, though very rarely, been observed as a propagation from the surrounding structures; but I am not aware of any cases in which it was discovered as an independent deposit. It presents itself in the form of small, rounded, ovoidal, or flattened tubercles, of a pale yellowish or light straw color, soft and elastic to the touch, and pervaded by numerous vessels, extended into them from the investing membrane.

It is equally rare that we meet with cancer in the female urethra. A few cases are mentioned in which it seemed to exist as an independent malady; but, in general, it extends to this tube as a secondary affection, from the adjacent parts, as the bladder and the rectum. Cruveilhier² relates an instance in which the walls of the tube were converted, throughout its entire length and circumference, into a carcinomatous cylinder, connected posteriorly with a similar disease of the vagina and uterus.

There are no *symptoms* by which, in either sex, carcinoma of the urethra can be distinguished from other affections. This is particularly the case when the disease exists as an independent growth, or without propagation from the surrounding structures. When it is of secondary character, it may be supposed to be present in consequence of the great ravages of the morbid action, and the gradual involvement of the tube. In Lallemand's case, before referred to,

¹ *Maladies des organes Genito-Urinaires*, p. 1, 1825.

² *Anat. Patholog. Livrais. XXIII. Pl. VI.*

the tumor was regarded as an ordinary stricture, and treated by cauterization, which had the effect of destroying the investing mucous membrane, without any beneficial impression upon the morbid mass itself.

No permanent benefit could be expected, in any case of this kind, from any mode of *treatment*, however skilfully directed, or perseveringly employed. The morbid action will be sure to progress, and to destroy, sooner or later, not only the part, but the patient. Should retention of urine occur, the morbid growth must be perforated with the catheter; or, when this is impracticable, the urethra must be laid open behind the tumor, to permit free egress to the pent-up fluid.

It is not improbable that *tubercles* of the urethra are more common than is generally imagined; it is so seldom, however, that this tube is opened in our dissections that it is not surprising that our knowledge upon the subject should be so very slender and imperfect. Louis states that he rarely examined the urethra of persons dead of phthisis, and, in the few cases in which he did, he found nothing peculiar. The deposit seldom, if ever, exists as an independent affection; but is almost always associated with tubercular disease of the bladder, prostate, kidney, testicle, or other organ. It occurs at various periods of life, and is probably more frequent in males than in females. Rayer met with an instance in a man of thirty-six, and he mentions one, which was communicated to him by Vernois, of a boy of twelve. In the former, the disease coexisted with tubercles of the prostate, kidneys, and testicles; in the latter, with tubercles of the kidneys and the peritoneum.

The deposit, which occupies the submucous cellular substance, and, probably, also the mucous crypts, usually occurs in the form of miliary tubercles, of which there are sometimes large numbers. It is generally limited to a portion of the tube, but occasionally it extends from one end to the other, as in the remarkable and very singular case observed by Ricord, in which the urethra was completely studded with these bodies. It was obtained from a man who, some years previously, had undergone the operation of castration, on account of strumous disease of the testicle. The prostate contained a tubercular excavation.¹

Of the symptoms, diagnosis, and treatment of tubercles of the

¹ Cyclop. of Anatomy and Physiology, vol. iv. p. 1350.

urethra, as little is known as of the different forms of carcinoma, already described, and it is not worth while, therefore, to detain the reader with any further account of them.

CHAPTER X.

INVERSION AND PROTRUSION OF THE MUCOUS MEMBRANE OF THE URETHRA.

THE mucous membrane of the urethra, like that of the bladder, with which it is continuous, is liable to become inverted and prolapsed at the external orifice of that canal. The affection is extremely rare, and is, for obvious reasons, confined to the female sex. No regular account has yet been published of it, as our data are still too limited and imperfect to enable us to do justice to the subject. The first case of which I find any record, was communicated to the profession by M. Sernin,¹ a French physician, in the latter part of the last century. It occurred in a girl, eleven years of age, for the last six of which she had suffered from frequent attacks of difficulty in voiding her urine. The mucous membrane formed a tumor at the vulva, four inches in length, of a deep reddish color, and of a cylindrical shape, with an open and fringed extremity, not unlike that of the Fallopian tube. Whenever an attempt was made to void the urine, the tumor became unusually prominent, enlarging in every direction. A similar example is mentioned by M. Seguin.² The patient, who was supposed to be laboring under strangulated hernia, when her physician was called in, had a tumor of considerable bulk, suspended between the pudendal lips, of a reddish complexion, and readily admitting the introduction of the catheter.

The above cases, to which, if necessary, others might be added, are typical of this form of disease as it occurs in the female urethra in different individuals and at different periods of life. The tumor, which is variable in size, being at one time small, and at another quite large, is generally of a cylindrical, rounded, or globular shape,

¹ *Recueil Periodique de Médecine*, t. xvii. p. 304.

² *Nouv. Journal de Médecine*, t. vi. p. 228.

with a ~~presence~~ of a reddish or purple hue, and entirely free from pain and soreness, except when it has been chafed, irritated, or inflamed. Its precise situation is towards the superior part of the vulva between the pudendal lips, where it may be seen protruding from the orifice of the urethra, which is itself usually considerably dilated for the more ready extension of the investing membrane of which it is composed. The centre of the tumor always contains a distinct opening, corresponding to the external meatus of the tube, and large enough to admit the passage of a well-sized catheter.

It is in general sufficiently easy to distinguish between this affection and inversion and prolapse of the bladder, described elsewhere. The most important *diagnostic signs* are that, in the former, the tumor is usually much smaller than in the latter, that it is more spherical or slender in its figure, that it is not liable to be attended with incontinence of urine, and that it does not receive any distinct impulse when the patient coughs, laughs, or sneezes. When the tumor is formed by the inverted bladder, we are generally able to detect the orifices of the ureters, while in the disease under consideration there is, of course, no such appearance.

The *causes* of this disease are similar to those of inversion and prolapse of the bladder. As the protrusion advances, the investing membrane becomes hypertrophied and preternaturally red, and the urethra is proportionably dilated for the reception and passage of the affected structures.

In the *treatment* of this disease, special attention is to be paid to the manner of voiding the urine. Instead of observing the usual posture, the patient should lie on her side or back, lest the tumor be forced down before the stream, and thus, by the frequent repetition of the act, be permitted gradually to augment in volume. When the protrusion has already made considerable progress, a cure will hardly be possible without the constant use of the catheter and the aid of astringent lotions and injections. The general health, if impaired, should, of course, be amended by tonics and other means calculated to invigorate the system, and impart strength to the affected structures. Recumbency, long continued and steadily persisted in, will, in nearly all instances, be an indispensable adjuvant. When the disease is obstinate, or has resisted the more ordinary remedies, excision may become necessary, as in the case observed by M. Sernin, already alluded to. Having assured himself, by repeated and careful examinations, that the tumor formed no

part of the bladder, but that it consisted wholly of the mucous membrane of the urethra, he cut it off, without any hesitation, with a bistoury, on a level with the meatus of the tube; a slight hemorrhage ensued; but this soon ceased spontaneously, and the cure was as prompt and complete as the operation was easy and simple.

CHAPTER XI.

INFILTRATION OF URINE.

By the term "infiltration," as applied to the urine, surgeons understand an escape of this fluid from the urinary passages, and its diffusion through the surrounding cellular tissue. It is usually restricted at the present day, though, as it seems to me, without much propriety, to the extravasations which occur at the neck of the bladder and along the posterior parts of the urethra. There are two forms of this affection, the vesical and the urethral, each of which requires brief consideration.

The accident, in whatever form it may present itself, is always a most unfortunate one, on account of the serious effects to which it is sure to give rise. The urine, naturally acrid in its character, and rendered, perhaps, still more so by disease, or by its protracted retention in the bladder, no sooner comes in contact with the tissues into which it has escaped than it lights up violent inflammatory action, which rarely ceases but with their destruction. The fluid in fact, instead of being an unirritating and harmless substance, as it is when it is confined within its proper reservoirs, now that it has become unpent, plays the character of a virulent poison, both to the part and to the system. In a few hours after the infiltration has taken place, excessive action is set up; the pain is of a sharp, burning, stinging nature; the skin, which presents an erysipelatous blush, is hot, dry, and exquisitely tender to the touch; the swelling is great and rapid; micturition soon becomes impracticable, if it was not already so at the beginning; and there is high constitutional excitement, with a rapid pulse, dryness of the surface, intense thirst, excessive restlessness, headache, and delirium. As the case proceeds, the affected parts assume a black, livid appearance, crepitate on pressure, and are deprived of their vitality; a urinous odour exhales

from the infiltrated structures, and sometimes even from the whole body; and the patient sinks into a low, typhoid condition, which is speedily followed by hiccough, twitching of the tendons, cold clammy sweats, the Hippocratic countenance, deep coma, and death. The period at which the latter event occurs varies from four to six or eight days, according to the extent of the infiltration, the acidity of the urine, the resulting inflammation, and the state of the system at the time of the accident. In some instances, the smallest quantity of urine, not, perhaps, exceeding a few drops, is sufficient to produce the most violent symptoms in four or five hours, followed by mortification and death in a few days; while in others, the effusion may be much more extensive and yet the effects be much more mild. Generally, however, the inflammation is of the most severe character, and is followed by the worst consequences.

1. *Vesical Form.*—The vesical form of the lesion may be produced by a rupture of the bladder from external violence, from over-distension from urine, or from perforative ulceration of the coats of the organ. After the operation of lithotomy, infiltration is unfortunately but too common, and is one of the chief sources of danger. This may depend upon two circumstances, either upon too extensive a division of the prostate gland, or upon the small size of the external wound; in the former case, the urine will be apt to insinuate itself into the subserous cellular tissue of the pelvic cavity, in the latter, into the cellular substance around the neck of the bladder and in the perineum. Severe and even fatal infiltration of urine sometimes follows the operation of lithotripsy, either from violence done at the time of crushing the stone, or from the impaction of sharp fragments at the neck of the organ, during the withdrawal of the instruments. I recollect a case of this kind where death was caused in a few days. Puncture of the bladder above the pubes, and the high operation of lithotomy, are both liable to be followed by infiltration of urine; and the same is true, only perhaps to a greater extent, of the recto-vesical operation. One of the worst and most extensive cases of extravasation I have ever witnessed was produced by a wound of the neck of the bladder from a spiculum of bone. When this organ is ruptured, as a consequence of external violence, the aperture is usually situated in that portion of its surface which is invested with the peritoneum, and death is almost certain to happen in two or three days from inflammation of this membrane.

Diagnosis.—Vesical extravasation is not always easily recognized

in its early stages. The diagnosis will, of course, be greatly assisted by a consideration of the history of the case. If the bladder has been long distended, its rupture, the immediate cause of the extravasation, may have been perceived by the patient at the moment of its occurrence; he is conscious that something has given way; he perhaps experiences the most delightful relief, and flatters himself that he will soon be well. A few hours, however, suffice to undeceive him; his sufferings recur with increased violence; he is unable to void a drop of urine; low muttering delirium sets in; excessive distress is felt in the pelvic cavity, and death usually ensues in thirty-six or forty-eight hours. In such a case the diagnosis is easy enough. The same is true when the symptoms previously pointed out exist after an operation, or an external injury.

Prognosis.—The prognosis in vesical extravasation is generally most unfavorable. Whenever the urine gains admission into the peritoneal cavity, it is exceedingly rare, however small may be the quantity of the effused fluid, that the patient recovers. Death under these circumstances is seldom postponed beyond the end of the second or third day. When the fluid is infiltrated into the subserous cellular tissue around the neck of the bladder, or at the base of the viscus, extensive gangrene is apt to occur, and to place life in imminent jeopardy, either proximally or remotely. Recovery, however, although extremely rare, in such an event, is not altogether impossible. The fluid may advance outwardly towards the perineum, and be discharged along with more or less pus and shreddy cellular substance, by the surgeon's knife, or by ulcerative action. The case will be tedious; the cure probably imperfect.*

Treatment.—The treatment of this variety of urinary extravasation is, in the highest degree, unsatisfactory. Several forms of it, in fact, are entirely beyond the reach both of the surgeon and the physician. What, for example, is to be hoped from any measures, however well planned or energetic, when the urine has been extravasated into the peritoneal cavity, or at all extensively into the subserous cellular tissue on the sides or at the base of the bladder? Surely nothing. Death will occur in spite of all we can do. There is, in truth, but one case in which vesical infiltration is in the least amenable to treatment, and that is where the urine has a tendency to advance towards the perineum. Here the treatment obviously consists in making early, free, and dependent incisions, to give vent to effused fluids, urinary, sanious, and purulent; and in sustaining the system by the timely use of tonics and stimulants, particularly brandy and

quinine, with a light but generous diet. "No case, in which an outward and efficient opening has been afforded, is to be considered too desperate. Nourishment and stimuli must be steadily administered. Unexpected and wonderful recoveries have rewarded perseverance."¹

2. *Urethral Form*.—The urethral form of infiltration is more common than the vesical, and, fortunately also, in general, more manageable. The cause under which it usually takes place is a laceration of the urethra, either in consequence of external violence, severe straining during micturition, as in stricture, the passage of a urinary calculus, or the maladroit use of instruments, as the catheter or bougie. When the canal is ruptured far back by a fall astride a chair, a blow, or a kick, infiltration of urine is almost inevitable. The accident is sometimes produced by violent straining in attempts to void the urine, on account of the obstacle afforded by a tight, callous stricture. In this affection, the portion of the urethra behind the obstruction is often remarkably dilated and attenuated, and therefore liable to give way under any unusual effort at micturition; the more so, because the muscular fibres of the bladder are generally at the same time very considerably hypertrophied. When the rupture follows upon such a cause, the urine is sent abroad into the connecting cellular tissue with great force, as if it had been discharged from a syringe, and gives rise to the most disastrous consequences.

Symptoms.—If the rupture takes place in the commencement of the membranous portion of the urethra, behind the triangular ligament, the case may remain obscure for several hours or even days; there is little or no prominence in the perineum from swelling, the scrotum is uninvolved, and the patient may not have been conscious of a sense of yielding, as he is when the bladder gives way. The urine is deep-seated, and may burrow extensively before it declares itself externally. The most reliable symptoms of the mischief that is going on, are, pain and throbbing deep in the perineum; difficulty, or utter impossibility of voiding the urine, with, perhaps, a frequent desire to do so; a sense of fulness in the anus and rectum; tenderness in the hypogastrium; and extraordinary constitutional disturbance. By and by, the urine makes an effort to approach the surface, its progress being preceded and accompanied by heat, pain, redness, and swelling, and by a rapidly increasing typhoid state of

¹ Miller's Practical Surgery, p. 356. Phila. 1849.

the system. In some instances, the first evidence of such an attempt, on the part of the fluid, is the appearance of a certain amount of tumefaction and discoloration, at first red, and then purple, of the gland of the penis; showing that the urine has obtained admission into the spongy structure of this organ, and that it is slowly but surely extending its ravages.

If the rupture occurs in that portion of the urethra which lies in front of the triangular ligament, between it and the bulb, the urine escapes into the cellular tissue of the perineum, and proceeds forwards and upwards underneath the dartos into the scrotum, which it often pervades through its entire extent. In its progress, it may travel along the subcutaneous cellular substance of the penis and the groins, over to the pubes, and sometimes even as high up as the umbilicus. The passage of the fluid is commonly indicated by a reddish, erysipelatous blush, which, on the approach of mortification, is generally replaced by a dark, livid, or black appearance of the skin. The swelling of the perineum, scrotum, and penis, in fact of all the parts here mentioned, is sometimes excessive. The reason why the urine does not, in this variety of rupture, extend backwards towards the neck of the bladder, round the anus, or downwards along the thighs, is the manner in which the triangular ligament and superficial fascia are attached to each other and to the edges of the branches of the pubic and ischiatic bones. There are, however, notwithstanding this arrangement, cases in which it breaks through these barriers, and spreads backwards upon the nates and the ischio-rectal fossæ, and downwards along the inner surface of the thighs, perhaps to a distance of many inches. In the worst forms of this affection, not only the scrotum, but the skin of the penis, the groins, and the upper parts of the thighs fall into gangrene, and the testicles, thus completely denuded, are suspended merely by the spermatic cords and vessels.

When the infiltration extends to the groin, the swelling induced by it may be mistaken for a hernia. In the following case, in which an error of this kind was committed, the patient was lost by the delay growing out of this circumstance.

CASE.¹—A professional gentleman sent a man to the Middlesex Hospital, London, saying that he was in imminent danger from strangulated hernia. Mr. Charles Bell, the surgeon in attendance, found him in a state of great exhaustion, comatose, and incapable of giving anything like a satisfactory history of his case. There was a

¹ C. Bell's Treatise on the Diseases of the Urethra, Vesica Urinaria, Prostate, and Rectum, p. 267. London, 1822.

swelling on the right side of the pubes, extending into the scrotum and perineum, in which there was a hole, leading to a ragged slough, the integuments exhibiting at the same time an erysipelatous blush. The alvine evacuations had been regular, and there was no fulness of the abdomen. On attempting to introduce a bougie, its passage was arrested by a stricture very near the external orifice of the urethra. Notwithstanding free incisions and other means, the man died in less than two days after his admission. A few deep and timely incisions would, as Mr. Bell justly remarks, have saved his life.

Urinary infiltration of the scrotum is liable to be confounded with ecchymosis of this organ, the more so, because both affections are frequently produced by the same accident, namely, a fall or blow upon the perineum. A careful examination of the part, however, and an attentive consideration of the history of the case, will generally enable us to distinguish between the two affections. In ecchymosis, the swelling and discoloration come on within a few minutes, or, at furthest, a few hours, after the occurrence of the injury, and are caused by an extravasation of blood from a rupture of some of the scrotal vessels. The patient is in great pain, and cannot void his urine, though he is compelled to make frequent efforts to do so; the parts are more or less distended by the effused fluid, and the skin is of a dark, livid, or purple color. The pain in ecchymosis is usually milder than in urinary infiltration, the constitutional excitement is also less, and there is an absence of the peculiar erysipelatous blush which generally precedes and accompanies the march of extravasated urine. The diagnosis is important to be clearly established, because the treatment of the two lesions is diametrically different.

Prognosis.—The prognosis of urethral infiltration is seldom flattering, though apparently the most desperate cases occasionally recover. Much will necessarily depend upon the nature and extent of the lesion which gives rise to it, the state of the system at the time of the injury, and the promptness and judgment with which the accident is managed in its earlier stages. If the urethra is extensively lacerated, so that little or no urine can pass off in that direction; if the patient is old or dilapidated at the time the mischief is inflicted, and if the extravasated fluid has become extensively diffused, little hope is to be entertained of a favorable issue. Death will be likely to happen in spite of all that can be done. The case is generally regarded as desperate when the urine is extravasated into the spongy body of the penis; an occurrence which is commonly preceded by severe pain and tenderness of the part, and a livid discoloration of the head of the organ.

Balarina mentions a case of recovery where there was sloughing not only of the integuments of the penis and scrotum, but of the cellular tissue of the loins and abdomen, as high up as the umbilicus, and of the thigh as far down as the knee. The patient had a good constitution, and proper counter openings were made.

Treatment.—The treatment of this variety of infiltration must be prompt and energetic, otherwise serious mischief, if not loss of life, will be the result. The first, and in fact almost the only thing, to be done, in the early stage of the affection, is to make large and dependent incisions, to afford vent to the pent-up and irritating fluids. The parts must be cut freely, not sparingly, at different points, and to as great a depth as is consistent with the safety of the large vessels of the perineum. The incisions should, of course, be made vertically, not obliquely, much less transversely. It is surprising to what an extent the affected parts may frequently be divided. Incisions that would shock an inexperienced or timid practitioner are borne with perfect impunity, and often heal with little deformity. In violent cases, mere scarification is worse than useless. The door must be widely opened, and the intruder must be forced out with a bold hand.

As soon as the distended parts have been freely and thoroughly divided, a gum-elastic catheter should be introduced into the bladder, and be allowed to remain there during the cure. The urine is thus enabled to pass off as fast as it reaches the bladder, and is thereby prevented from doing further mischief. The gum-elastic catheter is preferable, in these cases, to a silver one, on account of its greater softness and pliancy, which enable it to accommodate itself more readily to the urethra, altered and distorted as it frequently is by the accompanying tumefaction. The introduction of an instrument of any kind is often attended with immense difficulty, and is sometimes utterly impracticable.

The best local applications, after the parts have been properly incised, are warm fomentations of acetate of lead and opium, hops, or poppy-heads. They should be frequently renewed, and their heat and moisture should be maintained by oiled silk and dry flannel. When the sloughing process has fairly begun, the fomentations may be advantageously superseded by emollient poultices, with the addition of yeast, port wine, nitric acid, or chloride of soda, properly tempered with water. When the eschars are detached, the sore is to be managed upon general principles. Throughout the treatment, the scrotum and penis are to be supported with a suspensory

bandage. Should the parts remain fistulous, an operation may be required for their relief, but not until they have become thoroughly cicatrized in the neighborhood of the abnormal apertures. It is surprising, even when there has been the most extensive sloughing, how rapidly, in some instances, nature succeeds in repairing the injury. The testicles, as was before stated, are sometimes entirely denuded, or, perhaps, merely suspended by the spermatic cords, and yet, contrary to what might be supposed to happen in such cases, the breach is frequently closed in a very brief space with comparatively little deformity.

CHAPTER XII.

URINARY ABSCESS.

ABSCESSSES, to which the term urinary is usually applied, are liable to form in the cellular tissue round the urethra, leading, if improperly managed, to fistule and other mischief. The expression is a generic one, and is employed to designate any collection of pus, the exciting cause of which is an escape of urine from the urinary passages into a part which is unaccustomed to its presence, and which, therefore, never fails to resent the intrusion. Thus, a urinary abscess sometimes forms deep in the pelvis, in the perineum, or above the pubes, after puncture of the bladder, the operation of lithotomy, or injury of the bladder from a ball, sabre, or splinter of bone. As applied to the urethra, the term "urinary" is not sufficiently definite; for it denotes merely one circumstance in the history of this lesion, namely, the nature of the exciting cause. The nomenclature might be improved by the substitution of the word "urethral," or, still better, by the term "sub-urethral," inasmuch as it would serve to point out at once, not only the character of the affection, but likewise its situation.

Situation.—The ordinary site of urinary abscess is the perineum, between the bulb of the urethra and the anus. A very common situation also is the upper part of the perineum, just behind the junction of the cavernous bodies of the penis, and, consequently, at the inferior portion of the scrotum. The next most frequent point is the scrotum itself, and, lastly, the under surface of the

penis. Instances are observed, though they are rare, in which the abscess forms at the side of the anus, at the nates, near the tip of the coccyx, and at the upper and inner part of the thigh. It seldom happens that more than one such swelling occurs at a time. There may, however, be as many as two or even three.

Causes.—The exciting causes of the lesion are various. The most common, perhaps, is the existence of a tight organic stricture of the urethra, attended with attenuation and dilatation of the tube immediately posterior to it. A sort of pouch is thus formed, in which the urine habitually lodges, fretting and teasing the mucous membrane until it produces perforative ulceration. However minute the opening may be, a small quantity of fluid is sure to insinuate itself into the subjacent cellular substance, and to give rise to the lesion under consideration. Or, instead of this, the weakened and dilated part behind the seat of the obstruction may yield at one or more points during a violent effort at micturition, while the poor patient is, perhaps, straining with all his might to relieve the bladder of its accumulated load. A little crack or fissure, not larger, it may be, than a pin's head, may thus become a source of immense mischief and trouble. Or a rough, angular calculus may lodge in the urethra, and tear the mucous membrane, either as it is forced along by the pressure of the urine, or during an attempt at manual extrusion. Or a false route may be made with a bougie, sound, or catheter; or the urethra may be perforated by a sharp, narrow-pointed instrument, or it may be lacerated by a fall astride a chair, the bough of a tree, or an iron railing. The reason why false passages are not more frequently followed by infiltration and abscess, is doubtless because the urine does not find an easy entrance, on account of their direction from before backwards, which is the reverse of that of the natural channel. It is worthy of remark, that when the urethra is opened, to any considerable extent, by external violence, however inflicted, infiltration will be much more likely to result than abscess. It is only, in fact, when the aperture is exceedingly small, or where, if the reverse is the case, it is speedily glazed with lymph, that the one will be apt to be prevented and the other to form.

An abscess of this description is sometimes produced in another way. Matter, for example, is formed in the cellular tissue exteriorly to the urethra, and gradually extends inwards until it ultimately causes ulcerative absorption of the lining membrane, followed by an escape of the pus into the tube, and the ingress of a

2. DISEASES AND INJURIES OF THE URETHRA.

It is not infrequently introduced into the cavity of the abscess. Thus an abscess which is originally simple may be converted into a urinary abscess, or into a carbuncle, or an erysipelas, commencing in the neighbourhood of the urethra. A morbid cellular texture, may lead to the same effect. Abscesses situated near the urethra are liable to form under a variety of circumstances, of which the most important are gonorrhoeal inflammation of the structure and external injury.

There are cases in which this variety of abscess forms without any assignable causes, or without apparently any previous or co-existent disease of the urethra. This affection is very tardy in its progress, and seems to be occasionally connected with a scrofulous state of the constitution. In this respect it bears a striking resemblance to the abscesses which are sometimes developed around the anus, in individuals of both sexes.

Internal abscesses are generally small and circumscribed, and consist of an urinary infiltration, properly so called; for in the first stage the urinary fluid, under the influence of which they are formed, is bounded, or walled in, by a deposit of plastic matter. While in the other it is sent abroad into the connecting cellular tissue, and often spreads over an almost incredible extent of surface, depriving lymph, skin, and other structures rapidly of their vitality. In this respect, a urinary abscess may be said to bear the same relation to urinary infiltration, that a common boil bears to a carbuncle. In the one, the swelling is small, and circumscribed; in the other, it is diffused, the attendant deposit being copious, and consequently, incapable of setting limits to the extravasated fluid.

Symptoms.—The first evidence of an abscess of this kind is usually a small, deep-seated tubercle, tender on pressure, hard, distinctly circumscribed, and more or less movable. This gradually increases in bulk, and manifests a disposition to approach the surface, though, in general, six or eight days will elapse before it attains this point. The integument, previously free from discoloration, now assumes an erysipelatous blush, and often pits slightly on pressure; the pain and tension steadily augment; the structures around feel stiff and uncomfortable; throbbing takes place; the urine is passed with unusual difficulty, from mechanical compression of the urethra; and the patient is seized with shivering, alternating with flushes of heat. In this stage of the affection, the skin is hot and dry, the tongue is brown, the pulse is faltering, the thirst is intense, and there is excessive restlessness with a tendency to delirium. In the worst

variety of the lesion, the scrotum is cedematous, the perineum bulges out in the form of a large tumor, the parts around the anus are swollen and tender, defecation is painful, micturition is difficult, if not impracticable, and the patient is unable to walk about, or even to sit or stand. The contents of a urinary abscess are generally thin, dark-colored, acrid, and more or less fetid. The pus, which contains comparatively few globules, is usually intermixed with lymph, urine, and the débris of the affected parts.

There is a form of this affection, in which the symptoms are of a milder character, and which is almost entitled to the appellation of chronic. I have seen it more commonly in persons of a debilitated frame, with a tendency to tubercular disease of the lungs or other parts of the body. The swelling, in such cases, is remarkably tardy, and is seldom larger than a pigeon's egg, or a common marble. It is rarely attended, at least for the first week or ten days, by any pain, and there is but little discoloration of the skin. If left to itself, from twelve to eighteen days will elapse before it will break, and discharge its thick, and ill-elaborated contents.

Diagnosis.—The diagnosis of this disease is not always so easy as might, at first sight, be supposed. Its character may be suspected when a tumor, small, hard, circumscribed, and almost indolent, forms deeply in the perineum, or along the middle of the scrotum, in connection with stricture of the urethra, chronic gonorrhoea, or disease of the neck of the bladder; when its progress is unusually tardy, when it gradually approaches the surface, and when the skin, previously to giving way, is of a red, erysipelatous aspect. In the acute variety of the lesion, in which the symptoms are of a bolder character, the local affection is generally accompanied, especially after the first five or six days, by excessive constitutional disturbance, a feeble, faltering pulse, rigors, restlessness, and typhomania. In the traumatic form, a strict inquiry into the history of the case, particularly as to the manner of its occurrence, with a careful examination of the part, will usually enable us to arrive at a correct conclusion. After all, however, the matter is not one of much moment, in a practical sense, for in all doubtful cases, attended with local swelling and difficulty of micturition, the treatment is the same.

Effects.—Whatever may be the size, situation, progress, or real character of an abscess of the urethra, it is always necessarily followed by a fistule, through which the urine is afterwards discharged, either partly, or wholly, much to the discomfort and inconvenience

of the poor patient. The disease, therefore, although seldom dangerous to life, is always to be dreaded on account of this circumstance, which is so much the more unfortunate, because it does not always admit of relief by treatment.

Treatment.—The treatment of urinary abscess is sufficiently simple. The antiphlogistic regimen, rest, recumbency, leeching, and fomentation, will limit the morbid action; and an early external incision will prevent the diffusion of the matter and the urine. If stricture be present, it is removed in the ordinary manner. When the sac has been emptied, and the accompanying inflammation has, in a great measure, disappeared, a catheter should be retained in the bladder, to prevent the escape of its contents by the abnormal orifices, the edges of which are to be touched, from time to time, with nitrate of silver, to promote cicatrization. If the parts around the aperture remain hard and callous, they should be pencilled, once a day, with tincture of iodine, or well rubbed with camphorated mercurial ointment; to stimulate the absorbents, and hasten the removal of effused fluids.

CHAPTER XIII.

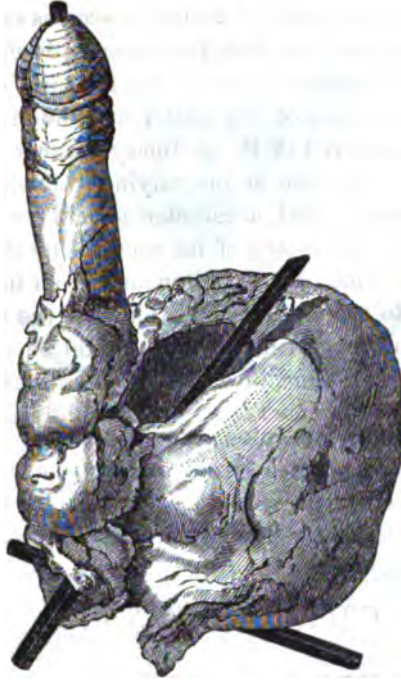
FISTULE OF THE URETHRA.

A FISTULE is an accidental track, narrow, straight, or tortuous, lined by an adventitious membrane, and communicating, on the one hand, with the urethra, and, on the other, with the cutaneous surface. To such a channel the term complete is usually applied, while the term incomplete is employed to designate that form of the affection in which there is only one orifice, whether internal or external. The latter distinction is absurd, and should be abandoned; for there is really no such disease as an incomplete fistule of the urethra, however true it may be of a fistule of the anus.

The most common site of fistule is that portion of the tube which corresponds with the perineum, and the scrotum; the disease sometimes occurs further back, and occasionally it exists near the anterior orifice. A rare form of fistule sometimes supervenes upon the operation of lithotomy, the abnormal channel extending from the urethra to the rectum.

The abnormal tracks vary much in extent. Those which occur in the spongy portion of the urethra are always very short, while

Fig. 182.



those which implicate the membranous and bulbous parts are sometimes remarkably long and sinuous. Cases have been witnessed in which they have passed down the thigh, backwards towards the anus, outwards towards the nates, inwards towards the pelvis, or upwards into the groin and the hypogastric region. In its diameter, the accidental passage may be so narrow as hardly to admit the finest bristle, or so capacious as to receive a large probe or a goose-quill.

Every fistule of this kind has two openings, of which the internal one is usually single, however numerous may be the branches of the abnormal track, or however riddled the cutaneous surface. In some cases, two, three, and even four orifices exist in the urethra; but this is very rare, and always constitutes a serious impediment to a permanent cure. The internal opening is generally of an irregular shape, and varies in size between the smallest pin's head and the end of the little finger.

The number of external openings varies in different cases (Fig. 183). Generally speaking, there is but one, or, at most, two or three. I have never seen more than five. Ledran¹ met with an instance of

Fig. 183.



thirty; and Civiale² refers to one of fifty-two. When the number is considerable the affected surface presents a riddled, sieve-like aspect. No regularity prevails in regard to the form and size of the external apertures. They may be circular, triangular, or oval, or they may have the appearance of a slit, rent, or fissure; and in their dimensions they may be so small, on the one hand, as to be hardly visible, and so large, on the other, as to admit the end of a probe, a grooved director, or a goose-quill. The situation of the external orifice is usually indicated by the presence of a red, fleshy papilla, which projects slightly beyond the level of the surrounding surface, and is constantly bathed with purulent matter, or pus and urine. Occasionally the opening has a sort of valve-like arrangement.

The abnormal track may be straight or sinuous, single or multiple. If a probe be introduced into the external orifice, it may pass on towards the urethra in a direct line, and this generally happens when the disease occupies the spongy portion of the urethra; on the other hand, the passage is frequently remarkably tortuous, especially if it be long, or situated in the perineum or scrotum. In most cases, there is at first only one track, but as this is liable to obstruction, fresh inflammation is excited, a new abscess forms, and in this way another channel is added to the previous one.

¹ *Traité des Opérations de Chirurgie*, p. 368.

² *Traité sur les Maladies des Organes Génito-Urinaires*, Premier partie, p. 393.

Thus, the original track possesses a sort of multiplying power, which is often employed to the great detriment both of the part and of the system.

This abnormal channel is originally nothing but a sinus, or tubular ulcer, which becomes soon covered by granulations, and ultimately by an adventitious membrane. This membrane, formed from the plastic lymph of the blood, bears, when fully developed, a very close resemblance to the mucous tissue, but differs from it in not having any follicles. Its free surface is smooth and polished, or rough and slightly granulated; the other is firmly attached by short cellular substance to the parts which it serves to line. This new membrane is usually very thin, firm in its consistence, and of a white, drab, or gray color; it is liberally supplied with vessels, nerves, and absorbents, is the seat of a constant secretion of mucopurulent matter, and is liable, like all new textures, to inflammation and its effects. In cases of long standing, it generally acquires a dense, fibrous character.

The fluid furnished by the new passage is generally thin and gleety, as in chronic gonorrhoea, and mingled with the natural secretions or excretions of the urethra. When the lining membrane is inflamed, or irritated, it is sometimes entirely suspended, or of a bloody, sanious, purulent, or muco-purulent character. The quantity of urine flowing along it varies from a few drops to several ounces in the twenty-four hours; and cases are not wanting, especially when the fistule is a consequence of impermeable stricture, in which all the water is discharged through it. The abnormal passage occasionally contains one or more calculous concretions, from the volume of a mustard seed to that of a cherry or hazelnut. They are developed in the passage, or they are conveyed into it accidentally from the bladder or the prostate gland. The parts in the immediate vicinity of the fistule are variously affected. Sometimes they are almost natural, or the changes which they have undergone are so slight that it is difficult to detect them; most generally, however, they are considerably swollen, very much indurated, chafed, excoriated, and exquisitely sensitive. If cut, they offer more or less resistance to the knife, and emit a peculiar grating noise. When the irritation has been very protracted, and the patient's health long deranged, they sometimes become the seat of carcinomatous degeneration. It is not often that the periosteum and the bones suffer in this disease, since their deep situation is generally an effectual protection against the contact of the urine.

Causes.—The immediate cause of this affection is a solution of continuity of the mucous membrane, produced by ulceration, abscess, gangrene, or laceration, and followed by an escape of urine into the connecting cellular tissue. Here, acting as a powerful irritant, the fluid speedily excites inflammation, which soon terminates in suppuration, or, it may be, in the death of the affected parts. When the matter is evacuated, or the slough detached, the urine, being no longer pent up, issues at the accidental opening, which now constitutes, in the legitimate sense of the term, a fistule. It is an error to suppose that the solution of continuity, leading to the establishment of this lesion, always begins in ulceration of the lining membrane; I am aware that this opinion is held by Sir Benjamin Brodie, an authority of the highest respectability; but I am sure that it is not borne out by the facts of the case, while it is equally certain that it is contrary to the experience of some of the most able pathologists of the present day. If the process which precedes the formation of the fistule be carefully watched, it will be found, in many cases, that it begins in the cellular tissue exterior to the urethra, in the form of a hard circumscribed swelling, seated, perhaps, deeply in the perineum, and gradually tending to suppuration, or the formation of an abscess. If the case be promptly met by a free incision, the proper treatment under such circumstances, the mucous membrane escapes unharmed, and the cavity of the abscess is gradually filled up by the joint agency of the granulating process and the contraction and approximation of its sides. In a word, no fistule can take place. If, on the other hand, the abscess, is neglected, or, what is the same thing, suffered to proceed, its contents, bound down by the perineal aponeurosis, and consequently unable to find an external outlet, will gradually but surely extend towards the urethra, the lining membrane of which it ultimately perforates. As soon as the matter has passed off, the urine is admitted into the cavity of the abscess, where it excites additional irritation, leading, perhaps, to the formation of a new abscess, and ulceration of the skin.

The efficient causes of urethral fistule are various. The most frequent, undoubtedly, is stricture, attended with dilatation of the tube behind the seat of the obstruction; but it may also originate from ill-managed attempts to pass instruments, or from the protracted sojourn of catheters and bougies, from gonorrhoea, retention of urine, external violence, and the operation of lithotomy. I have several times seen the urethra become fistulous in consequence

of chancre, situated either within the tube, and extending outwards, or commencing on the surface of the penis, and proceeding inwardly. Occasionally, the disease originates in obstruction of the tube by a urinary calculus. The mucous membrane behind the obstacle is gradually dilated and attenuated, and finally takes on ulceration, which, advancing to the deeper structures, leads to an escape of urine, and the formation of an abscess. The opening left by the evacuation of the matter remains fistulous, and affords vent to the urine. The same train of phenomena takes place in stricture. The mucous membrane posterior to the obstruction, being constantly fretted and irritated by the presence of the urine, ultimately gives way, and the disease in question is the speedy consequence.

Symptoms.—A person affected with urethral fistule is to be regarded as an object of the deepest sympathy and commiseration. Although he may be able to retain his urine for a considerable interval, or, perhaps, even the usual period, yet whenever he attempts to void it, a certain quantity always escapes at the abnormal channel, wetting his clothes, and irritating the skin of the perineum, the scrotum, and the thighs. When the opening is situated far back, there may be an incessant dribbling, and, in such a case, no care can secure his comfort, or protect him from the offensive smell which exhales from him wherever he goes. The parts in the immediate vicinity of the fistule are constantly sore, swollen, excoriated, and subject to new attacks of inflammation, which are often followed by new abscesses and new tracks. In the more severe forms of the complaint, the patient finds it difficult, if not impossible, to move about, or take his accustomed exercise; the bladder becomes irritable, and intolerant of its contents; the calls to micturition increase in frequency; the urine is loaded with mucus, and exhales a disagreeable, ammoniacal odor; the general health declines; the appetite fails; the body wastes; and the poor sufferer, abandoned to despair and wretchedness, hails death as a welcome messenger.

Diagnosis.—The diagnosis of this disease is usually easy. An opening exists in some portion or other of the urethra, and this opening transmits a urinous fluid, either in drops, in jets, or in a continuous stream, synchronous with the act of micturition. The quantity of fluid evacuated by the natural route usually varies with the character and degree of the obstruction upon which the fistule depends. In some instances, nearly the whole passes off by the accidental passage; in others, only a few drops or teaspoonsful.

When the track is situated in the membranous or prostatic portion of the tube, the urine may dribble away constantly; but this is rare. A probe, of small size, introduced into the external orifice, readily enters the urethra, provided the abnormal passage is not very narrow, oblique, angular, or sinuous. When this is the case, it may be difficult, if not impossible, to effect the object, however adroitly or perseveringly we may conduct the operation. Where there is any doubt upon the subject, the surgeon should recall the history of the case, or the circumstances which preceded and accompanied the formation of the fistule, explore carefully the course of the urethra, both internally and externally, and observe whether the discharge of urine at the outer opening is synchronous with that of the natural channel.

Prognosis.—In regard to their prognosis, it may be observed that urethral fistules are, in general, a source of inconvenience rather than of danger. When the disease is of an aggravated character, and is complicated with an intractable stricture, life may gradually be destroyed by constitutional irritation, or by local suffering from disease of the bladder, the prostate gland, or the kidneys. In simple fistule no such result is to be apprehended. The case, if well managed, is productive of little trouble, and is readily relieved by treatment. When the affection is accompanied by great loss of substance, or when it involves the posterior and more deeply-seated portions of the tube, it may be incurable, and render the patient miserable for life. A fistule of the urethra has sometimes been followed by impotence, not from a want of erection or ability to copulate, but on account of the escape of the greater part of the spermatic fluid by the accidental route.

Treatment.—The treatment of this affection, although obvious enough, is not always easy. The first thing that is to be done is to seek for, and, if possible, to remove, the exciting cause. In most cases this will be found to be a stricture, probably of long standing, more or less tight, and semi-cartilaginous, attended with inflammation, perhaps even ulceration, of the mucous membrane, and dilatation of the tube behind the seat of the obstruction. Having already, in a previous chapter, spoken at length of the character and treatment of this affection, it is not necessary to refer to the subject here any farther than to observe, that, when the disease upon which the fistule depends is removed, the abnormal track ordinarily closes of its own accord, and the urine gradually resumes its accustomed route. In all cases, it is a matter of great moment, as I conceive, as soon as

circumstances will admit of it, to retain a catheter permanently in the bladder, in order that the urine may flow off, from time to time, without coming in contact with the internal opening of the fistule. Although this is the more necessary when the fistule is deep-seated, and affords a constant drainage, I prefer it, as a general rule, to the frequent introduction and withdrawal of the instrument, which are always attended with the risk of injuring the affected part, and involve an amount of attendance which few practitioners can bestow. It is to be understood, of course, that the permanent retention of the catheter is not to be persisted in when it becomes a source of decided suffering, either as it respects the urethra, the bladder, or the prostate gland; nor is the treatment to be thought of when it does not fulfil the intention for which it is employed. If the urine flow by the side of the instrument, between it and the urethra, no benefit can result from its presence, and the sooner it is removed the better. The instrument, to answer the purpose, should be rather over than under the usual size; it should distend the urethra gently, not forcibly, and it should be provided with large eyelets, to prevent it from becoming clogged with mucus. It should, moreover, be composed of silver, a substance far preferable to gum-elastic, which is easily softened and roughened by the urine, and requires to be frequently replaced in consequence. If the catheter is too large, it will be apt to dilate the internal orifice of the fistule, and prevent the approximation and reunion of its edges. If, on the contrary, it is too small, it will not only not answer the object for which it is employed, but become a source of irritation both to the urethra and the abnormal track, from its constant contact with the urine.

Conducted upon the principles now mentioned, this mode of treatment rarely fails in the more mild and uncomplicated forms of the malady. When the natural route for the urine is re-established, the fistule gradually contracts, the indurated parts regain their normal consistence, and the external orifice is ultimately obliterated. The cure may often be greatly expedited by a strict observance of the antiphlogistic regimen, and by the application of leeches, blisters, and astringent lotions to the affected parts. When there is much induration, the most appropriate topical remedies are tincture of iodine, and camphorated mercurial ointment. Obstinate sinuses must be laid open with the knife.

It sometimes happens, after all obstruction in the urethra has been removed, that the fistule manifests no disposition to heal, but remains pervious to the urine. Several causes may give rise to this occur-

rence. In the first place, it may be owing to the presence of a calcareous concretion, which, as was previously stated, sometimes forms in a passage of this kind, and prevents it from closing. The proper remedy, of course, in such a case, is to remove the foreign body, for as long as it remains no progress towards a cure can be expected. The extraction may be effected either with the forceps alone, as when the passage is very spacious; or with the forceps and knife when it is narrow, or small and sinuous. Secondly, the indisposition to unite may depend upon the presence of an abnormal pouch, or upon an unusually large internal orifice. In either case, the proper remedy is a free incision, so as to enable the parts to heal from the bottom. Thirdly, the occurrence may be owing to the peculiar nature of the lining membrane of the accidental track, which may be of a firm, almost semi-cartilaginous consistence, and be constantly bathed, on its free surface, with a thin, glairy mucus, thus preventing the opposite sides from adhering. When this is the case, the object should be to destroy the secreting surface, and to promote the granulating process, by means of stimulants or escharotica. One of the best remedies for accomplishing this end is the nitrate of silver, which may be used either in substance, as when the fistule is very shallow, or in the form of a tolerably strong solution, carefully introduced with a small ivory syringe, or a common probe. Forty grains of the salt to the ounce of water is the proportion which I usually employ, and I seldom repeat the application oftener than once every forty-eight hours. Sometimes I have used with advantage a piece of sulphate of copper, cut to a delicate point, and retained for ten or twelve seconds in the abnormal passage. In obstinate cases, recourse may be had to the occasional introduction of a heated wire, or to a probe dipped in nitric acid, a concentrated solution of lunar caustic, or the acid nitrate of mercury. Too much caution, however, cannot be observed in the use of these and similar remedies, which are well calculated, if applied too freely, to cause severe inflammation and even sloughing. The object, in all cases, should simply be to destroy the lining membrane, without involving any of the surrounding tissues. Any tendency to premature closure of the external orifice is prevented by touching its margins, every few days, with caustic potash, or some other escharotic substance.

When the fistule is obstinate and protracted; when its internal orifice is uncommonly large, or when there are several openings of this kind; or, finally, when it depends upon an old stricture, so firm, narrow, and extensive, that it cannot be destroyed in the ordinary

manner, the only course left is to lay the parts open by an external incision; a procedure which often remarkably expedites the cure of both affections. The patient is placed as in the operation of lithotomy. A grooved director is carried down to the stricture, and held there by an assistant, while the surgeon introduces a probe into the fistulous track, just behind the obstruction, and then divides the intervening structures with a knife. A silver catheter, of suitable size, is next conveyed into the bladder, and retained there until the wound is nearly healed; care being taken to withdraw it occasionally for the purpose of cleanliness. When the cicatrization is completed, the usual means are employed to prevent a recurrence of the contraction.

When the fistule involves the spongy portion of the urethra, and has been caused by chancre, or external injury, attended with loss of substance, it may be necessary to have recourse to *suture*, as the more ordinary means not unfrequently fail, in consequence of the difficulty with which the accidental opening cicatrizes in this situation. The suture usually employed is the twisted, made with very short, slender needles, placed not more than a line and a half apart. A middle-sized catheter having been previously introduced into the bladder, the edges of the opening are carefully pared, as in hare-lip, and then nicely approximated, the ends of the ligatures being passed from one needle to the other, the points of which are next broken off with the forceps. Instead of this suture, some surgeons recommend the interrupted, which, however, does not possess any advantages. Dieffenbach suggested the plan of running the suture round the fistulous orifice, after the fashion of a purse-string. When the thread is tightened, it draws the skin into puckers, and approximates the edges of the aperture so completely as to enable them occasionally to unite by the first intention. Several cases in which this treatment has been successfully employed have been published by Dieffenbach and other surgeons.

The principal objection against the employment of the suture, in any form, for the relief of this affection, is its liability to tear itself out before the completion of the adhesive process, in consequence of the morbid erections which are so apt to take place after the operation. It is this occurrence which so frequently mars the result of our efforts, and renders it necessary to repeat them. To guard against these erections, which often become troublesome within the first few hours after the operation, recourse should be had to ano-

dyne enemata, or suppositories of opium and camphor, and to the application of pounded ice to the perineum and hypogastrium.

It has been proposed, as a kind of dernier resort, in obstinate and intractable fistule, in which the ordinary methods have failed, to divert the urine from the accidental channel into an artificial one, so that none may come in contact with the raw edges before they are firmly united. The operation has been sanctioned by high authority, and has been employed successfully in several instances. In a case treated by Ricord, with whom the suggestion originated, the opening was situated anterior to the scrotum, in the spongy portion of the urethra; in which, from the great thinness and mobility of the tissues, the disease is often extremely difficult to heal. He made an incision into the membranous portion of the tube, and kept it open for the passage of the whole of the urine until the accidental track was completely united, when it was permitted to close. The patient had been previously subjected to various methods without the slightest benefit.

Excision has sometimes been practised with advantage. When the parts in which the stricture is situated are unusually callous and circumscribed, an elliptical portion, embracing the external orifice, is cut out, and the raw surfaces are approximated by suture over a silver catheter, previously introduced into the bladder.

When the abnormal track is attended with considerable loss of substance, *urethroplasty* may become necessary. This term is employed to designate a process which has for its object the restoration, by the transplantation of a piece of healthy integument, of a part of the urethra that has been lost, either partially or wholly, by accident or disease. The operation, which requires no little skill for its successful issue, is chiefly applicable to fistules opening into the spongy portion of the tube. Different modes of urethroplasty have been devised, each of which possesses, perhaps, certain advantages in particular cases; none of them, however, are very certain in their results, and hence it is a good rule never to resort to them as long as there is any prospect of affording relief by other means.

One of the most simple of these processes is that of Dieffenbach, which consists in paring the raw edges of the opening over a catheter, previously introduced into the bladder, so as to form a crescentic cleft, the long diameter of which corresponds with that of the penis. A longitudinal incision is then made on each side of the cleft, when the intervening integuments are raised in two bridge-like flaps, and united closely at the middle line by numerous points

of the interrupted suture. The catheter remains in the parts until the adhesion is completed, which will be about the fourth or fifth day.

When the fistule is situated on that part of the urethra which corresponds with the head of the penis, a closure may sometimes be effected by inverting a piece of the prepuce, and fastening it by means of the twisted suture. A case in which the operation was entirely successful is mentioned by Mr. Costello, of London, in the *Cyclopædia of Practical Surgery*.

Alliot, a French surgeon, anxious to avoid the inconveniences which frequently result from the passage of the urine between the catheter and the parietes of the urethra, has proposed to convert the orifice of the fistule into a simple ulcer, by elevating the integument on one side of the accidental channel, drawing it across the aperture, and fastening it securely by the twisted suture to the corresponding edge, previously rendered raw. This ingenious process seems to have been completely successful in the hands of its inventor.

The Indian method, as it is called, is performed by closing the gap by borrowing the integuments from the neighboring parts, as the scrotum, the perineum, or the thigh. The callous edges of the opening are previously pared so as to produce a new surface, when a portion of sound skin is dissected off, except at one point, and inserted into the wound, to which it is accurately fitted, and then secured by suture; the whole being supported by a compress and bandage.

CHAPTER XIV.

FALSE PASSAGES.

A FALSE passage is an artificial canal, communicating with the urethra, and generally produced by the injudicious use of a bougie or catheter. All portions of the tube are subject to it, but it is most frequent in the membranous and prostatic, owing to the inequality of their surface, and their fixed position beneath the pubic symphysis. A false passage sometimes occurs at the sinus of the bulb from the point of a catheter being arrested in it; and for the same reason it occasionally commences in one of the numerous folli-

cles of the lining membrane. The accident, however, is generally produced in consequence of the existence of a stricture, in attempting to force which the instrument leaves the natural channel, in front of the obstruction, and makes a new one. In cases of chronic enlargement of the prostate, the substance of this gland is occasionally perforated, to afford an exit to the urine.

False passages are much more easily made than is generally believed, and it is only surprising, when we reflect upon the want of anatomical knowledge and dexterity in the use of instruments, that they are so seldom met with. When the mucous membrane is softened, or chronically inflamed, as it frequently is in firm, semi-cartilaginous strictures, it often yields under the slightest pressure, and hence it is not unlikely that the accident occasionally occurs when it is not in the least suspected.

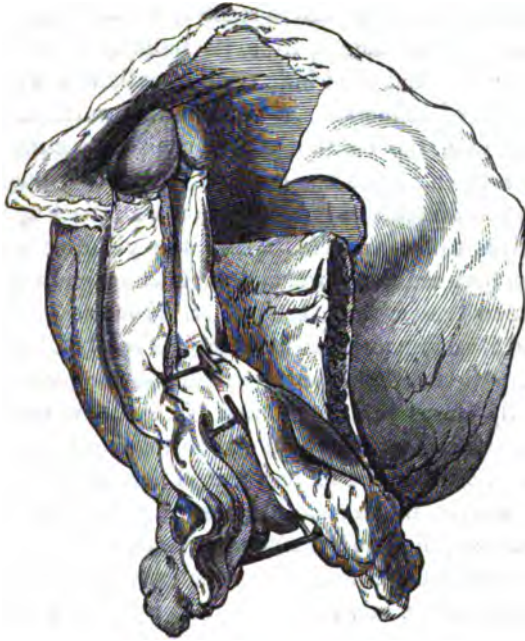
Situation, Number, and Length.—The artificial route is commonly situated at the inferior surface of the tube, chiefly because when an instrument is attempted to be introduced into the bladder, its point is almost always pressed in this direction, which also presents the greatest number of natural obstacles to its easy passage. Sometimes the perforation occurs at the sides of the urethra, and occasionally also, but rarely, at its superior surface.

It is rare to find more than one such channel. Two, however, are occasionally met with; and Civiale mentions an instance in which there were three, one above, another below, and the third on the right side. In Fig. 184, taken from a specimen in the Pathological Museum of the New York Hospital, the number was still greater. When several such passages coexist, they sometimes communicate with each other.

The length of the artificial route varies from a few lines to several inches. Sir Charles Bell relates an instance where it was four inches; it ran parallel with the natural channel, between it and the rectum, and had been made by a catheter, which had pierced the mucous membrane in front of a hard, gristly stricture. A similar case fell under my own observation in 1847, in a colored man, between thirty and forty years of age, a servant of Mr. Thornton Thompson, in the neighborhood of Louisville. He had been affected with stricture for many years, and finally died of abscess of the left kidney. Upon dissection, in which I was assisted by my former pupils, Dr. Bozeman, of Alabama, and Dr. Summers, of Virginia, I found a tight, semi-cartilaginous stricture, just behind the head of the penis, from the anterior part of which a false passage ran along the inferior sur-

face of the tube nearly three inches and a half in length. The preparation is in my private collection. Generally speaking, however,

Fig. 184.



these false routes are comparatively short, not exceeding, perhaps, ten, fifteen, or twenty lines.

Varieties of Form.—False passages occur under different varieties of form, of which the following are the principal: 1. The most simple, and generally also the least dangerous form, is where it presents itself as a cul-de-sac, or blind pouch, running parallel with the urethra, from which it is often separated merely by the mucous membrane; it varies in length from a few lines to several inches, and may occur in any portion of the tube, though it is most frequent at its posterior part. 2. In a second variety, the false route, after having extended a certain distance, communicates again with the urethra, which is thus perforated at two distinct points. The abnormal channel, in time, becomes lined by an adventitious membrane, and often performs the functions of the original one. 3. The passage communicates with the bladder. This variety, which is by no means infrequent, is usually the result of an attempt to force a stricture of the membranous portion of the urethra; in which the point of the instrument

passes out of the natural channel into the cellular tissue between the rectum and the bladder, and thence on into the latter organ. In some instances, the catheter perforates the substance of the prostate, runs round its side, or proceeds along its upper surface. Whatever course the instrument may take to reach the bladder, the occurrence is always one of great danger, from its liability to be followed by infiltration of urine, and the whole train of evils which such an accident is capable of inducing. 4. In a fourth variety, the passage communicates with the rectum. That such an occurrence should occasionally happen, in the hands of an ignorant or unskilful practitioner, it is not difficult to imagine when we reflect upon the little force it requires to lacerate the urethra, the yielding nature of the cellular tissue between the bowel and the bladder, and the close proximity of these two reservoirs to each other. Much as the accident is to be deprecated, it is a remarkable fact that it is rarely followed by anything serious; the track neither admits urine nor fecal matter, and, in fact, usually closes in a few hours. 5. Authors mention a fifth case, in which the abnormal route opens both into the rectum and the bladder. To produce this result, it is necessary that the vulnerating body should, in its onward passage, pierce the bowel twice, entering it at one point, and emerging at another to reach the latter viscus. An occurrence like this, of which a remarkable example is related by Deschamps, might be followed by severe inflammation, and possibly, also, by a recto-vesical fistule. 6; and, finally, an instance is upon record where the false route extended from the urethra to the ischium.

A false passage, in its recent state, is merely a laceration of the mucous membrane and the neighboring tissues, which either heals within a short time after it has been made, or it continues open, and becomes lined by an adventitious membrane, differing in no material respect, except in the absence of mucous follicles, from the natural structure. In time, the new channel may usurp the place of the original, which, as it has no longer any functions to perform, gradually diminishes in size, and is occasionally, especially in protracted cases, nearly obliterated.

Causes.—The immediate cause of this lesion, as was previously intimated, is undue force, or misdirected pressure, exerted in the act of dilating a stricture, cauterizing the urethra, drawing off the urine, or sounding the bladder. An instrument of some kind or other is indispensable to its production; and hence it is almost needless to add how important it is for the surgeon to be upon his guard whenever he

attempts any operation, however simple, upon the canal under consideration. To avoid the formation of a false passage, he should not only be acquainted with the urethra in its healthy and diseased states, but he should have a most thorough knowledge of the nature and uses of the various instruments which are designed to traverse it, whether for its own benefit or for the relief of the prostate gland, the bladder, and the seminal vesicles.

The predisposing causes of this lesion may be arranged under two heads, the natural and the accidental. A brief enumeration of these circumstances will not be without its benefit, for it will serve as a beacon to warn us of the danger of the heedless and injudicious use of instruments in the treatment of urinary affections.

The natural causes are the mucous lacunæ, the sinus of the bulb, the margins of the triangular ligament, the sinus pocularis, and the anterior border of the prostate gland; and, it is worthy of remark, that these obstacles to the easy introduction of the catheter nearly all exist along the inferior surface of the canal. Hence, to avoid them, the instrument should be gently pressed against the upper part of the urethra, by which its beak will be made to glide past these obstacles without any danger of being intercepted by them. Care should also be taken that the extremity of the instrument be not too pointed, as this will render it more liable to become entangled in the folds of the lining membrane or in the mouths of the mucous follicles.

The accidental causes, predisposing to the formation of false passages, are, first, an inflamed, softened, or ulcerated state of the mucous membrane; secondly, a preternatural development of the lacunæ or mucous follicles; thirdly, the existence of a tight, narrow, semi-cartilaginous stricture; fourthly, a deviation of the urethra from its natural direction; and, fifthly, the nature and form of the instrument used in our operations.

It does not require much foresight to perceive that the mucous tissue of the urethra, when in a state of disease, will be much more likely to give way, under the pressure of a bougie or catheter, than when it is perfectly healthy. The existence, therefore, of ulceration or softening of the lining membrane of this canal may be justly regarded as a predisposing cause to the formation of a false passage. The same is true of an unnaturally large follicle, and of a firm stricture. The situation of a stricture also exerts an important influence upon the production of this lesion. The deeper it is situated the less manageable is it generally found to be, and the more likely, there-

fore will be the instrument, employed to dilate or cure it, to tear the urethra. A deviation of this tube from its natural direction is by no means rare; I have seen several remarkable examples of it, and have never known one which did not seriously embarrass me in my efforts to introduce an instrument into the bladder.

Much also depends upon the form and character of the instrument used in our operations. A flexible catheter or bougie is less likely to produce mischief than a metallic one; a blunt, than a conical one; a curved, than a straight one. Finally, a great deal depends upon the character of the surgeon; whether he is skilful or ignorant, patient or hasty, gentle or rough.

Effects.—The effects of a false passage vary according to circumstances. When it consists of a mere cul-de-sac, little or no harm generally results. The slight inflammation which succeeds its formation usually subsides in a few days, and is just sufficient, in most cases, to cause adhesion of the opposite sides of the artificial channel. The reason why the accident so frequently occurs, even far back in the tube, without being followed by extravasation of urine, is that the fluid does not find an easy entrance, on account of the valve-like opening in the mucous membrane, and the oblique direction of the passage from before backwards, which is the reverse of the natural stream. When the route exists in the vicinity of the bladder, or when it communicates with this reservoir, the danger may be very great, for it may then give rise to infiltration, abscess, and even gangrene. When it extends into the rectum, or the rectum and bladder, a fistule may follow.

Symptoms.—The formation of false passages is seldom indicated by any reliable symptoms, and the consequence is that it often occurs without being suspected either by the patient or the surgeon. This is the less to be regretted, because, in a great majority of cases, the lesion neither requires nor admits of any remedy. The most constant evidences are, hemorrhage, pain, and a feeling of laceration; but, if these be examined in detail, it will be found, as has been just intimated, that they are of no value whatever as diagnostics. More or less bleeding, for example, may follow any operation upon the urethra, however gently or skilfully conducted. This is true of this tube both in its healthy and diseased states. Every surgeon of experience has seen cases in which the slightest touch with a bougie or catheter has been followed by a tolerably smart hemorrhage. No just inference can be deduced from the nature and amount of the pain consequent upon such an injury, for the greatest possible diversity prevails, in this

respect, in different individuals, depending upon the natural or morbid sensibility of the tube, the state of the system, and the extent of the laceration. It has been said that, in a false passage, it is of a stinging, pricking character; but this is not always true, on the one hand, and on the other, it is equally certain that the same kind of suffering frequently attends the dilatation of a stricture. Finally, the tearing sensation, complained of by the patient, is altogether deceptive; for it is often experienced when no laceration has taken place. On the whole, then, no confidence whatever can be placed in any of the symptoms furnished by the patient. How, then, is the existence of the lesion to be determined? Is any reliance to be put in the observation of the surgeon? The only circumstances worthy of notice, as far as he is concerned, are, first, a peculiar grating sensation communicated to his hand, while engaged in operating upon the urethra; secondly, a sudden slipping of the instrument from its position, or a feeling as if something had given way; and, thirdly, a deviation of the instrument from the normal direction of the canal. Although these accidents do not positively indicate the formation of the lesion in question, yet when they occur, the surgeon should at once desist, and finish his operation at some future period.

Treatment.—The treatment of false passages must be conducted upon general principles. Hemorrhage must be arrested, pain allayed, and further irritation, by the use of instruments, prevented. Rest in the recumbent posture, light diet, purgatives, antimonials, leeches, fomentations, and the warm hip-bath will, in general, put a speedy stop to the local inflammation. The false route, if complete, and consequent upon the presence of an impermeable stricture, will become gradually lined by an adventitious membrane, and in a short time take the place, and perform the office, of the obliterated part of the urethra. Should retention of urine occur, and resist the ordinary remedies, relief must be attempted, either by breaking down the original obstacle, if this be deemed advisable or practicable, or by puncturing the bladder. If the symptoms indicate the existence of urinous infiltration, early and free incisions must be made, followed by anodyne fomentations, and the usual internal means.

CHAPTER XV.

LESIONS OF THE GALLINAGINOUS CREST.

THE gallinaginous crest, or, as it is often denominated, the verumontanum, is liable, from its situation at the floor of the prostatic portion of the urethra, and from its intimate relation to the orifices of the ejaculatory and prostatic ducts, to inflammation and its consequences. The lesions of this body were first described, though in a brief and unsatisfactory manner, by Sir Everard Home, in his *Treatise on the Diseases of the Prostate Gland*. Since that period they have been noticed by other observers, and they have recently been made the subject of a short chapter in the excellent work on the urinary organs by Dr. Civiale, of Paris. Whether the lesions of the gallinaginous crest ever exist as independent affections, or whether they always occur in association with disease of the neighboring structures, is not clearly ascertained. The question is one of difficult solution, and can be determined only by dissection, which, unfortunately, the practitioner seldom has an opportunity of performing.

Acute inflammation of the gallinaginous crest is most commonly induced by an extension of gonorrhoeal inflammation, by stricture of the urethra, by disease of the ejaculatory ducts, and by the presence of prostatic calculi. It may also be excited, there is reason to believe, by rough horseback exercise, by inordinate sexual indulgence, and by the injudicious employment of instruments. Stimulating diuretics, such as cantharides and spirits of turpentine, may also give rise to it. The crest, when thus affected, is of a florid appearance, of a soft, spongy consistence, and slightly increased in volume, in consequence of interstitial deposits. Lymph is sometimes effused upon its surface, either in the form of minute points, or as a distinct layer.

There are no signs by which, in the present stage of the science, it is possible to distinguish this affection from disease of the adjacent parts. The spasm, pain, and frequent desire to urinate, together with the increased secretion of mucus which accompany it, also

attend inflammation of the prostate gland and the neck of the bladder, and are, therefore, valueless as diagnostics. The circumstance is, fortunately, of little moment in a practical point of view, inasmuch as the treatment is essentially the same, in whichever of these structures the malady is located. Under the influence of antiphlogistics, vigorously plied, the lesion rapidly subsides, and the part gradually recovers its original character. Neither ulceration nor gangrene is likely to occur, unless the inflammation has been induced by external violence, attended with extensive laceration of its tissues.

The gallinaginous crest is liable to *hypertrophy*, or chronic enlargement; the result, doubtless, of inflammation and interstitial deposits. In stricture of the urethra and hypertrophy of the prostate, I have repeatedly seen it from three to four times the normal volume, at the same time that it was considerably indurated, and changed in its configuration. Occasionally, it deviates a good deal to one side. The size which this body sometimes attains is almost incredible. Thus, in an instance recorded by De Blégny, it formed a projection as big as a small walnut. The seminal fluid was of a thick, vitiated quality, and the ejaculatory canals were choked up with small, hard, spherical concretions, as large as peas. The patient, a widower, sixty years of age, and the father of several children, contracted a second marriage, but he never could produce an emission, although he had perfect erections. In an old man who died of retention of urine at the Hôtel-Dieu, in Paris, the verumontanum was as large as a big walnut. The hypertrophy was associated with profound disease of some of the other portions of the urinary passages, and it was, therefore, impossible to ascertain the amount of influence it exercised during the patient's life.¹

When the verumontanum is much enlarged, it is generally of a pale, mottled complexion, more or less deformed, and considerably augmented in its consistence. Its mucous membrane is thickened, villous, and traversed by large vessels; while its proper substance is of a whitish, or grayish aspect, intersected by fibrinous bands, and so firm as almost to grate under the knife.

Hypertrophy of this body, existing in any considerable degree, must necessarily obstruct the flow of urine, and interfere with the introduction of the catheter. In this respect, in fact, its effects

¹ Civiale, *Traité Pratique des Maladies des Organes Génito-Urinaires*, deux. ed. partie 2de, p. 234.

must be similar to those produced by hypertrophy of the prostate, especially of its middle lobe. From its intimate relations with the ejaculatory ducts, it must also impede, if not wholly prevent, the discharge of semen, and may thus become a cause of impotence. This was evidently the case in the individual whose history has been narrated by De Blégny, and which is alluded to in a previous paragraph. Sir Everard Home met with an instance in which the orifices of the ejaculatory ducts were covered over by a false membrane.

Hypertrophy of the urethral crest has no symptoms of its own, and hence the utmost uncertainty must always exist with regard to its diagnosis. The phenomena which attend it must be such, in the great majority of instances, as indicate obstruction to the flow of urine, and the passage of instruments accompanied, in all probability, by an increased discharge of glairy, viscid mucus. A careful exploration with the metallic catheter, aided by the finger in the rectum, may throw some light upon the case, by pointing out the precise seat of the enlarged body; but, in general, even this fails, and the practitioner is, therefore, obliged to abandon himself wholly to conjecture. This being the case, it is obvious that the treatment of the affection must be conducted according to the common rules of surgery; or, more properly speaking, upon the same principles as chronic disease of the prostate gland, the neck of the bladder, and the posterior portion of the urethra.

CHAPTER XVI.

INFLAMMATION AND ABSCESS OF COWPER'S GLANDS.

IN connection with the lesions of the gallinaginous crest, we may here briefly notice the diseases of Cowper's glands, so far at least as they are at present known. These two bodies, which are situated between the two lamellæ of the triangular ligament, and which, in their normal state, are hardly as large as a common pea, are subject to inflammation and its consequences. They are also liable to atrophy and hypertrophy; and instances occur in which one of them is absent, or where one is unusually small, while the other is of the

natural size, or disproportionably large. Their consistence is sometimes so much increased as to lead to a belief, probably not very well founded, that they are subject to the scirrhus degeneration. When they are much indurated, the glands are of a whitish color, rough on the surface, and remarkably granulated in their texture. I am not aware that these little bodies are ever the seat of tubercular deposits, and yet there is no reason why they should be exempt from it. It is probable, judging from their structure and their proximity to the urethra, that the diseases of these glands are not only more frequent, but also more complicated in their character, than is generally supposed; but as they are seldom, from their isolated position, the subject of examination, their affections are generally overlooked.

Inflammation of these glands is most apt to arise during the progress of gonorrhoea, from an extension of the irritation of the urethra along their excretory ducts. It may, however, be produced by other causes, as a blow or fall upon the perineum, urinous infiltration, or disease of the prostate gland and neck of the bladder. The probability also is that they sometimes suffer in stricture of the urethra. Be this as it may, the disease either comes on insidiously, or it is characterized by bold and open symptoms, such as pain and tenderness in the perineum, heat or scalding in the urethra, and a frequent desire to urinate, with more or less fever. The distress, both local and general, is aggravated if matter forms; the swelling increases; there is difficult micturition, on account of the distension of the surrounding parts; the skin of the perineum becomes discolored; fluctuation is perceived; and, finally, the abscess breaks and discharges its contents. In general, however, a number of days must elapse before this can happen, owing to the deep situation of the matter and the manner in which it is bound down by the perineal fascia and the anterior lamella of the triangular ligament. Nor does it always, if, indeed, generally, manifest a tendency to evacuate itself externally; on the contrary, there is reason to believe, from what has been just stated in relation to its situation, that it is more frequently discharged into the urethra.

The diagnosis of this disease must necessarily be unsatisfactory; for there is hardly any surgeon whose sense of discrimination is so acute as to enable him to distinguish between it and abscess of the surrounding structures. The treatment must, therefore, be conducted upon general principles, being directed, in the first instance, to the mitigation of the inflammatory symptoms, and afterwards, if

suppuration occur, to the evacuation of the matter. When there is great local distress, accompanied by a sense of tension and throbbing, with a livid state of the skin, no time should be lost in making a free incision: otherwise the abscess may burst into the urethra, and thus lead to urinary infiltration. After the matter has been evacuated by the knife, the inflammation will gradually disappear, and the parts will regain their natural condition. Any induration that may remain may be readily discussed by the application of iodine, camphorated mercurial ointment, leeches, and blisters.

APPENDIX.

§ 1.—PREVALENCE OF STONE IN THE BLADDER AND CALCULOUS DISORDERS IN THE UNITED STATES.

AN account of the prevalence of calculous diseases in this country has long been an acknowledged desideratum with the profession. That no attempt of this kind should ever have been made is remarkable, especially when we consider the intelligence and enterprise of our physicians. The only rational explanation that can be offered of the circumstance is the gigantic nature of the undertaking, for which few men, competent to execute it, have either the time or the inclination. The facts which form the basis of this division of the subject have been collected with great care, and comprise, it is believed, an accurate outline of our knowledge upon the subject. However this may be, it is to be hoped that they will not be without value, and that they will have the effect of awakening further and more extended inquiry into the locality and etiology of a class of affections of so much interest and importance. It will be perceived that, in the composition of this part of the work, I have laid my professional brethren, in various sections of the country, under heavy contributions; and my only regret is that my space has been too limited to permit me, in many cases, to make freer use of the materials which their kindness has placed at my disposal. Without their co-operation, my remarks upon this subject would necessarily have been very meagre, and therefore destitute of much of their present value.

It will be noticed, in reading this part of the work, that the great stone regions of this country are, as far as is at present known, Kentucky, Tennessee, Virginia, Ohio, North Alabama, and, perhaps, Missouri. In all other sections of the country the disease is either very infrequent, or comparatively rare. To what these differences are due has not been determined. To my mind, it is positively certain that no one cause can, or does, produce them. Doubtless, a combination of circumstances is at work, but of the nature and influence of this we are entirely ignorant. If we seek for an explanation of the difference in a difference of climate, geological formation, and habits of life, we shall be disappointed; for there are really no essential variations in any of these particulars between the several States above mentioned, or between these States and those which are, in a great degree, exempt from these affections. Thus, there is no essential difference in the climate, soil, and productions of Kentucky and Indiana, or in the food, drink, occupation, and modes of life of their inhabitants; and yet in the one, as will be presently seen, stone in the bladder is very frequent, and in the other very rare. It remains for medical philosophers to inquire into these circumstances, and to unravel them, if possible, in a scientific and tangible manner, for the benefit of the profession and the public.

The food of the inhabitants of the calculous regions does not differ from that used in some of the other States, where the disease is more rare. The most

common articles are wheat and corn bread, unleavened biscuit, potatoes, hominy, tomatoes, cabbage, turnips, apples, and meat, with coffee, tea, and milk at breakfast and supper. Corn-bread and pork—fresh, salted, and smoked—are consumed in large quantities by the negroes, as well as by the whites. Much of the food is taken hot into the stomach, as well as hastily, and consequently without due mastication. Many of the families, even among the lower classes, eat meat twice and even thrice a day. In the western and south-western States generally, a vast deal of poultry is consumed; eggs are also freely used; and there is, perhaps, no portion of the globe where milk enters more profusely into the diet of the inhabitants.

Lime-water is used by a large majority of the people in the calculous districts; but, what is remarkable, it is as freely employed in other portions of the country where stone in the bladder is either altogether unknown, or where it exists only very rarely. Thus, in certain parts of New England, Canada, and the west, as Indiana and Illinois, the disease is quite uncommon, and yet lime-water is generally drank by the inhabitants. Malt liquors are not much used, except in our towns and villages. Our German emigrants consume large quantities of beer, and are, I am inclined to think, singularly exempt from calculous disorders. At Cincinnati, where I resided seven years, and where there was, at the time, a large German population, I never knew or heard of an instance of stone in the bladder among them; nor have I met with any examples in this city. Professor Pope informs me that the disease is rare among that class of citizens in St. Louis. Ardent spirits, in the form of grog, juleps, toddy, and bitters, are very commonly used by the lower orders in almost every section of the country, and not a little is drunk by the middle and higher classes. The consumption of wine varies in different parts of the Union, but is probably, as compared with alcoholic drinks, nowhere very great. Cider was formerly a good deal employed, especially in several of the States, as New Jersey, Pennsylvania, and Ohio, but is not now much in vogue as a table drink. The use of tobacco is of almost universal prevalence among males.

The climate is essentially the same in the calculous regions of this country. Abrupt and extreme vicissitudes of temperature are common during the winter months. Heavy rains fall in October, December, February, and March. Thunder storms, with fierce lightning, begin to prevail in May, and increase in violence and frequency until August. The summers are usually very oppressive, and characterized by protracted droughts. The late autumnal, the winter, and early spring months are unfavorable to an active condition of the cutaneous perspiration, owing to the chilly and humid state of the atmosphere, which forms so remarkable a feature of the climate of the southwest. Hence the vicarious office of the kidneys is often called forth, and a predisposition established to calculous deposits.

The prevalent diseases in the calculous regions are intermitting and remitting fevers, neuralgia, pneumonia, dysentery, rheumatism, and dyspepsia, the latter of which is exceedingly frequent in both sexes, and at nearly all periods of life. Urinary deposits of various kinds, especially the lithic acid and urates, are common.

How far, or in what respect, the development of stone is affected by food, drink, occupation, and climate must, for the present, remain a matter wholly of conjecture. That they do exercise an influence, and that an important one, would seem extremely probable, and yet no one has ever succeeded in determining its character, or the share which each of these circumstances has in the production of the malady. If the use of corn bread, hominy, and bacon induce stone in the bladder in Kentucky and Tennessee, why do they not cause it in Indiana and Illinois, where these articles are consumed quite, or nearly quite, as freely as in the former States? So in regard to climate; humidity of the atmosphere and the sudden vicissitudes of temperature are not greater in Kentucky and Tennessee than in her two neighbors. Corn bread, as stated in the text, is wholly unknown in the calculous districts of Europe; and in the East Indies, where, according to Mr. Brett and other writers, stone in the bladder is sufficiently frequent, a "hoe-cake" has probably never been seen. Be-

sides, as has been noticed elsewhere, the negroes of the south and southwest live almost exclusively on corn bread, hominy, and bacon, and yet they are much less liable to the disease than the whites of the same region. In Norfolk, England, where the disorder is so frequent, its development has been ascribed to the employment of the coarse dumpling, so common in that country; and in India to the derangement of the digestive apparatus occasioned by the constant use of unleavened bread and various kinds of rancid sweetmeats. "Causa latet" is as true of stone in the bladder as of a hundred other diseases, and it is, therefore, idle to speculate respecting it.

Maine.—Maine has few cases of calculous affections. At Thomaston, which is in the midst of the great limestone region of that State, the oldest practitioners have never seen an instance. Dr. M. R. Ludwig, who has been in constant practice in that town upwards of thirty years, has not met with a single case that originated in that district; and Dr. Merrill, of Rockland, who has resided twenty-seven years in the midst of the limestone region, has not been more fortunate. A solitary case of gravel was observed by Dr. D. Rose, in a practice of sixteen years. Limestone water is constantly used for drinking and culinary purposes. The inhabitants are exempt from intermittent fever.¹

New Hampshire.—The inhabitants of New Hampshire are equally exempt from stone in the bladder with those of the other New England States. Dr. Mussey, who practised medicine and surgery for many years at Dartmouth, informs me that he lithotomized only ten persons before he removed to Cincinnati, in 1838. Cases of stone have, doubtless, occurred in the hands of other practitioners; but the disease must, on the whole, be remarkably rare.

Vermont.—Vermont seems to be singularly exempt from calculous disorders. My colleague, Professor Palmer, formerly of Woodstock, informs me that stone in the bladder is very rare. During a residence of fourteen years in that State, he knew of but one operation for the relief of that disease. He is of opinion that four-fifths of the entire population of the State drink water which is more or less impregnated with lime. In many parts it contains so much of this substance as to be unfit for any domestic purpose, except for cooking and drinking.

Massachusetts.—Up to 1844, when Professor Warren,² of Boston, published his paper on the Bilateral Operation of Lithotomy, the number of calculous cases in that city was astonishingly small. "In the course of forty years," says he, "I have been called on to perform all the operations of lithotomy which have been done, during that period, in the city of Boston. The whole number has not exceeded twenty-five, inclusive of lithotritry cases, in a population which, during the period mentioned, has increased from about 26,000 to more than 100,000. Of the twenty-five persons thus operated on, not more than three were natives of Boston or its vicinity: the others came from the remote parts of Massachusetts, from New Hampshire, from a calcareous district in Maine, and from Nova Scotia." Dr. Warren, in alluding to the probable causes of this comparative immunity from calculous disease in his region of country, states that Boston and its immediate vicinity contain no calcareous rocks, that the spring-water abounds in muriatic salts, and that the whole locality is exempt from intermittent fever.

Dr. J. Mason Warren has lately informed me that he has had fifteen cases of stone in the bladder, of which fourteen were cured by operation. The other case was deemed unfit for surgical interference. The following table exhibits the age and sex of his patients, and the nature of their calculi:—

¹ I am indebted, for the above facts, to Dr. Henry C. Levensaler, of Thomaston.

² Am. Journ. Med. Sciences, N. S., vol. viii. p. 233. 1844.

NO.	AGE.	SEX.	CALCULUS.
1	49	Male	Lithic acid.
2	70	Male	Lithic acid.
3	25	Female	Phosphate of lime.
4	41	Male	Phosphate of lime, with a nucleus of sealing-wax.
5	23	Female	Phosphatic.
6	39	Male	Oxalate of lime.
7	43	Male	Cystic oxide.
8	15	Male	Oxalate of lime.
9	4	Male	Phosphatic, with a nucleus of pebble-stone.
10	45	Male	Oxalate of lime.
11	60	Male	Oxalate of lime with phosphates.
12	54	Male	Triple phosphates.
13	53	Male	Triple phosphates.
14	25	Male	Oxalate, with phosphate of lime.
15	74	Male	Lithic acid, with layers of phosphates.

No. 6, 8, 9, and 11, were natives of Boston; No. 15 was born there, but had passed the greater part of his life in other portions of the country.

In the Museum of the Boston Society for Medical Improvement are 22 calculi, removed from different persons in New England, and the composition of which exhibits much variety. Five consist of uric acid, surrounded, in one, by thin layers of oxalate of lime and the mixed phosphates; three of uric acid and the urates; one of urate of ammonia; two of uric acid and mixed phosphates; one of urate of ammonia and mixed phosphates; one of uric acid and urate of ammonia, inclosed by mixed phosphates; one of uric acid and mixed phosphates with urates of potash and ammonia; one of urate of ammonia and oxalate of lime; two of phosphate of lime; two of mixed phosphates; two of oxalate of lime; and one of oxalate of lime and mixed phosphates.¹

Connecticut.—According to Dr. J. Knight,² Professor of Surgery in Yale College, calculous affections are exceedingly rare at New Haven, as well as throughout the whole State of Connecticut. From his statement, it would seem that no one born in that city and its vicinity has ever undergone the operation of lithotomy, and that there have not been, as far as he is able to learn, more than six or eight cases, during the last fifty years, in which vesical concretions have been discharged by the urethra. Urinary deposits, or gravel, are more frequent, yet are not of common occurrence. New Haven, at the beginning of the present century, contained about 6,000 inhabitants, the number of which has gradually increased to 30,000.

The same exemption from diseases of this kind prevails throughout Connecticut. Dr. Knight believes that he is acquainted, either personally or by direct information, with all the cases of lithotomy that have occurred in different parts of that State during the past fifty years, and he is certain that the number does not exceed twenty-five, or one in about two years, in a population, at present, of 370,000. There may have been, though he thinks it is not probable, an equal number of cases in which no operation was performed, owing to the obscure character of the disease, or the late period at which it was discovered.

The cases of stone, observed by Dr. Knight, have been very equally distributed throughout the State. "The late Dr. Nathan Smith, Professor of Surgery at New Haven, and at Dartmouth, New Hampshire, and who was well acquainted with the diseases of New England, used to affirm that there were more cases of stone in Vermont and Maine than in any other parts of this region. I believe he attributed this fact to the greater abundance of limestone in those States. How far facts will warrant this conclusion, I am uncertain. I have thought that calculous affections are most prevalent in those places which are subject to intermittent fever and other diseases of malarious origin. I have

¹ Transactions of the American Medical Association, vol. III. p. 90. 1860.

² MS. Letter to the Author, Aug. 30, 1854.

not, however, examined the subject sufficiently to warrant an opinion of this kind."

Rhode Island.—Stone in the bladder is of rare occurrence in Rhode Island. Dr. Usher Parsons,¹ of Providence, formerly Professor of Surgery in Brown University, in that city, informs me that from six to eight cases are all that he has heard of as having originated in the State, during the last fifty years. Renal calculus, on the contrary, appears to be of rather frequent occurrence, especially among high-livers and persons affected with gouty complaints.

New York.—For the following statistics of lithotomy and calculous diseases of Western New York, I am indebted mainly to my friend Dr. F. H. Hamilton, Professor of Surgery in the University of Buffalo.

"Nearly the whole of Western New York, as the term is generally understood, and including about eighteen counties, is a limestone district. It comprises all of the State west of that space of the Alleghany Mountains which traverses the State nearly north and south, and crosses the Mohawk River at that point, and all north of a range of mountains which extends nearly east and west along the southern tier of counties."

Most of this region is moderately undulating, and is almost everywhere underlaid with limestone. The entire population, according to the last census, is little less than 1,000,000. The inhabitants are, in general, temperate and industrious. Nearly the whole country has been settled within the memory of many now living, and, therefore, the observations of Dr. Hamilton upon the malady in question, have extended back to its earliest permanent occupation by the white race.

Thirty-eight cases of stone, which may have originated in this district, have come to Dr. Hamilton's knowledge, and of these, twenty-nine were operated on. The surgeons were Amasa Trowbridge, of Watertown, Webster and Elwood, of Rochester, John De La Mater, of Fairfield, Silas White, of Cherry Valley, Balchelder, of Utica, Alden March, of Albany, F. Hyde, of Courtland, J. T. Pitney,² of Auburn, W. C. Butler, of Avon, V. Mott, of New York, L. Guiteau, of Winton, and Sprague, Chapin, White, and F. H. Hamilton, of Buffalo.

Dr. Hamilton states that, with the exception of his own cases, he has no analysis of the chemical characters of any of the calculi. In every instance but one the knife was employed. Dr. Butler operated upon a female by dilatation and crushing. Of the twenty-one males operated on sixteen recovered, and of three the result has not transpired. Two died in consequence of the operation; one on the 18th day, and the other on the 14th. Their ages were, respectively, twenty and twenty-four; the lateral incision was made, and the calculi were large.

Of the sixteen patients that were cut successfully, two had, as a consequence of the operation, recto-vesical fistule, of which they were eventually cured; another had the same affection, but remained unrelieved; and a fourth had a spermatic fistule.

The lateral operation was performed in most of the cases. The high operation was employed in one instance by Dr. Webster, in which he had failed, some months before, to reach the stone by the lateral method.

Of the seven females, six recovered, and of these two had had vesico-vaginal fistule; in both, the urethro-vesico-vaginal operation had been performed. Two of the remaining five were cut by the lateral incision, and had afterwards partial incontinence of urine. One was operated on by dilatation and crushing, with a similar result. The other female operated on by the lateral method died on the third day.

The nine additional cases, alluded to by Dr. Hamilton, have either died without operation, or are still living and unrelieved.

Dr. Hamilton supposes that it would be fair to conclude that about as many more cases have occurred in this region as those which he has reported to me, thus making the whole number, from the first settlement of the country to the

¹ MS. Letter to the Author, Aug. 19, 1854.

² Dr. Hamilton states that this gentleman had operated five times, but he has not informed me of the results.

present time, seventy-four. Of these, two-thirds only, he thinks, originated in the district, the remainder having been brought there.

Dr. Hamilton himself has performed the operation for stone five times, which appears to be oftener than the same operation has been performed by any other surgeon, except Dr. Trowbridge, now living in Western New York. Two of his patients were females, and three males. The first case in the subjoined table was from Canada, and is, therefore, not included in the thirty-eight cases belonging to the region of country above specified.

AGE.	SEX.	OCCUPATION.	LOCALITY.	GEOLOGICAL FORMATION.	OPERATION.	CALCULUS.	RESULT.	REMARKS.
23 y's	Male	Drygoods clerk	Kingston, Canada West		Lateral section	Fusible calculus in its outer laminae, and oxalate of lime as a nucleus	Cured	Patient had rickets also.
3 y's	Male		Rome, Oneida Co., N. Y.	Limestone	Lateral section	Urate of ammonia—shape ovoid, and composed of concentric laminae	Cured	
24 y's	Male	Farmer	From birth a resident of Nunda, Alleghany Co., or of Evans, Erie Co. Buffalo, Erie Co.	Limestone	Lateral section	Weight 4 oz., longest diameter 2 in. and 4ths; fusible of pur-calculus, with some carbon-ate of lime	Died on 14th day	
24 y's	Female	House-maid		Limestone	Lateral section	Fusible calculus, with traces of lith-ates; weight, over 4 oz.	Died on 3d day	Stone was encysted, and the patient in extremity when the operation was made.
22 y's	Female	House-keeper	Busti, Chata-que Co.	There is no lime in this neighborhood, but the land is richer than in a lime district	Lateral section		Cured	Has partial incontinence of urine.

Dr. Amasa Trowbridge,¹ of Watertown, Western New York, informs me that he is acquainted with all the cases of urinary calculi that have occurred in the counties of Jefferson, St. Lawrence, Lewis, and Oswego, in the first of which he has resided forty-three years. He has operated altogether eighteen times; three of his patients were females, and three of the males were lithotomized on account of foreign bodies introduced into the bladder. Of the other patients, four were children, whose ages, respectively, were two years and two months, four years, seven years, and nine years; the ages of the rest varied from twenty-one to forty-seven. All the cases recovered, and have remained well. Only nine of the cases originated in the above counties, which now contain 240,000 inhabitants. The other patients were afflicted with the complaint before they settled there. The whole of that section of the country is underlaid with limestone, and nearly all the wells furnish hard water, which is very generally employed for drinking and culinary purposes. Few cases, however, of calculous

¹ Professor Hamilton's Letter to the author, May, 1854.

complaints are, it would seem, traceable to its use. In two of the above cases, Dr. Trowbridge had reason to believe that the malady was congenital.

Professor March, of Albany, has communicated to me a table of sixteen cases of stone, only two of which originated in that city, where he has practised surgery for thirty-four years. One or two other cases have occurred during that period in residents of the place, and a few have been operated on at Troy, six miles up the Hudson. "With this exception," says Dr. March, "I do not know that any other physician within a hundred miles of me has had a case of lithotomy during all this time." For the last thirty-six years he has been cognizant of the results of the dissections of from six to twenty-five subjects annually, and yet he has never known but two instances of stone in the bladder, one in New England and one in Albany.

Dr. March's patients were all, except one, males; their ages varied from three years to seventy-five, seven being under fifteen. Fourteen were cut by the lateral method, and in two the stones were crushed. Of the former, one died in about two weeks, apparently from metastatic abscess. In one case, that of a child three years old, the calculus could not be extracted, and death occurred about two years after the operation. One of the patients had been lithotomized before by another surgeon, a fragment of the concretion having probably been left in the bladder.

The city of New York, with a population of nearly 700,000, does not furnish many cases of stone in the bladder. Out of nearly 4,000 cases of disease treated in the New York Hospital in 1853, there was, so far as I have been able to ascertain, only one case of lithotomy. Professor Mott informs me that he has, on an average, from five to six cases of stone a year, and that he has cut altogether, since the commencement of his professional career, 163 persons. The State of North Carolina has furnished Dr. Mott with more cases than any other in the Union. Professor Parker has had only twenty-four operations of lithotomy during a residence in New York of fifteen years. Dr. Alexander H. Stevens, as will be seen by a reference to the tables under the head of statistics, has had 32 operations. Drs. Watson, Buck, J. R. Wood, Hoffman, Carnochan, and Post, have each had some cases, but of the precise number I am not informed. How many of these cases originated in New York I have no means of determining; but it may be presumed, from the character of the operators, that not a few were from abroad.

Professor Van Buren has operated altogether twenty times for stone in the bladder. Out of the whole number, two of the calculi were composed entirely of lithic acid; the rest were compound in their character, principally triple phosphate. Two had nuclei, one being formed by a bit of slate-pencil, and the other by a head of wheat.

During the last seventeen years and a half, that is, from November, 1837, to April, 1855, there were operated on in the New York Hospital¹ fourteen cases of stone in the bladder, and one of stone in the urethra. Of these cases seven were from New York, two from Pennsylvania, one from Massachusetts, one from Canada, one from Germany, two from Ireland, and one from England, the last being a seaman. Among the New York patients was a negro boy, six years old. In one of the cases the stone was crushed, and in four it was removed by the bilateral section. This hospital admits annually, on an average, upwards of 3,500 patients.

Of the above cases, fourteen recovered, and one proved fatal, death being caused by shock within a few hours after the operation. In another case, under the care of Professor Van Buren, the patient got well of the operation, but died soon after from pneumonia and rapid deposit of miliary tubercles. The disease had existed upwards of four years, and the stone, which weighed nearly four ounces, had formed round a bit of slate-pencil.

During the last four years, ending December 31st, 1854, there have been, as I learn from Professor Carnochan, four cases of stone in the bladder in the State Emigrants' Hospital at New York, and during the same period there

¹ I am indebted, for the facts relative to this Institution, to Dr. Edward W. Derby, the Resident Surgeon, by whom they were politely drawn up for me at the request of my friend, Professor Van Buren.

were admitted into its wards 53,000 patients affected with disease of all kinds; affording thus a ratio of 1 to 13,250. The majority of the inmates of the institution are Irish and German, the former of whom, as will be seen by and by, are generally exempt from stone in the bladder in their own country. Besides these cases, Dr. Carnochan has, during the last four years, treated several others, but only one of them had originated in the city of New York.

New Jersey.—Dr. S. W. Butler, of Burlington, Editor of the *New Jersey Medical Reporter*, says: "Judging from what I have seen and heard, and from the reports of our county and State Medical Societies, I conclude that calculous disorders are very rare, indeed almost unknown, in this State." I know myself from personal observation, that stone in the bladder is infrequent in this State. Most of the cases which occur in the northwestern portions of New Jersey are operated on in the city of New York.

Pennsylvania.—Stone in the bladder is uncommon in the inhabitants of this State. In the Pennsylvania Hospital at Philadelphia, from the time it was opened for the admission of patients in 1752, until May, 1848, a period of one hundred years, only 83 patients were cut for this disease. Of these patients the residence of not a solitary one is recorded; but I have reason to believe that the majority, if not most of them, were from abroad. Be this as it may, it is certain that but few of them originated in Philadelphia and its vicinity. Of the above cases, the ages of 36 only are given; of these, 28 were under fifteen years, and but 2 over twenty-five. With the exception, perhaps, of a few children, all were operated on with the gorget. Seventy-two cases recovered, ten died, and one was discharged unrelieved.¹

I have not been able to ascertain the number of cases of stone in the bladder operated on by the Philadelphia lithotomists. Up to 1842, as I learn from Dr. Keese's edition of Cooper's Surgical Dictionary, Professor Gibson had cut 50 patients; Dr. J. Rhea Barton, 36; and the late Dr. George McClellan, 30. The entire number of cases operated on by the latter, as I have recently learned from his son, Dr. J. H. B. McClellan, amounted, at the time of his death, to nearly 50. Of these, the great majority were relieved by the lateral section, a few by the bilateral, and the remainder, probably six or eight, by the suprapubic. Of the number of cases treated by the late Dr. Randolph, by Dr. Mütter, Dr. Norris, and others, I am not informed. Dr. Randolph operated chiefly by crushing, and Dr. Gibson has occasionally performed the same operation. Dr. Pancoast has had forty-one cases. Dr. Ashmead, up to 1848, had performed the bilateral operation four times. Dr. Henry H. Smith, has cut 5 cases. How many of the above cases originated in Philadelphia I have no means of ascertaining; nor is it in my power to say how many of them belong to the list of cases operated on in the Pennsylvania Hospital, with which some of the lithotomists here mentioned were for a time connected as surgeons.

Of the prevalence of stone in the bladder in Philadelphia, nothing very definite is known, except that it is inconsiderable. Dr. Henry H. Smith, whose indefatigable zeal in surgery is well known, informs me that he is acquainted with most of the cases of stone operated on by the prominent surgeons of that city during the last twenty years, and that he is satisfied that the disease is comparatively rare, most of the patients lithotomized there having come from abroad. "Fourteen cases," he remarks, "are all that I have been able to find recorded, or that I distinctly recollect as having originated in the city since 1834. Seven of them were operated on by the late Dr. Randolph, and were residents of Philadelphia where the disease was developed. They were all males, and their ages were, respectively, 27, 30, 50, 57, 60, 64, and 67. Two cases of children occurred in the practice of the late Dr. J. M. Wallace, and five in my own. Of these, 4 were males, and one was a female; their ages being 3, 8, 9, 40, and 54. Thus we have 14 cases within my knowledge, and embracing most of those published since 1834, as far as I have been able to investigate them. Of the cases operated on in the Pennsylvania Hospital the locality is not stated. Since 1834 the population of Philadelphia has not been

¹ Transactions of the Amer. Med. Association, vol. I. p. 102, 1848.

less, I think, than 250,000, and is now, I believe, from 450,000 to 500,000; so that if we treble the number of cases above referred to, which would probably cover all that have occurred among our inhabitants, it will be seen that the complaint under consideration is comparatively rare."

Professor Gilbert, who has lived in Philadelphia, more or less, during the last eleven years, is personally cognizant of only three cases of lithotomy, performed during that period, upon citizens of the place. He has himself performed several operations of the kind upon patients from abroad, and he knows of a few others, performed by other surgeons; but he is satisfied that stone in the bladder is very rare. Similar testimony is borne by Dr. J. H. B. McClellan, son of the late eminent surgeon. During my residence in Philadelphia, as a student and practitioner, a period of upwards of five years, but few cases of lithotomy occurred in that city, either in private or hospital practice.

Professor Pancoast has operated, by cutting and crushing, on 41 cases, of which 20 occurred in Philadelphia. Of the other 21, 2 were from New Jersey, 3 from Delaware, and the remainder from the following counties in Pennsylvania, namely: 3 from Chester, 2 from Lancaster, 1 from York, 1 from Carbon, and 1 from Lehigh. The residences of the rest are not recollected. Of these cases, nearly one-fourth were from portions of country free from calcareous matter. Professor Pancoast thinks that the malady is on the increase in Philadelphia, in a degree disproportionate to the increase of population.

In the whole of Eastern Pennsylvania, stone in the bladder is very infrequent. Professor Gilbert, who resided for twenty years at Gettysburg, Adams County, knew of but one case within the entire range of his practice. The patient was a negress, aged 60 years, whom he successfully lithotomized in 1851. Indeed, the disease is rare in every portion of the State east of the Alleghany Mountains, as I have satisfied myself by inquiries of numerous respectable physicians.

In the western part of the State, calculous diseases are, apparently, more common. Dr. J. Dickson, of Alleghany, has operated, by the lateral section, on fourteen cases of stone, within the last seven years. In thirteen of these cases, the concretions were composed of lithic acid; and in the other, of phosphate of lime. All his patients were males, mostly boys, and every one recovered. He has never seen any cases of stone, or renal calculi, among the colored population of Western Pennsylvania, although this is considerable.

Dr. Dickson does not think that the use of limo-water predisposes to the development of urinary calculi in this part of the country. Many of his ordinary patients, it would seem, take as much lime in this way in a year as would form, if retained, a concretion as large as a good-sized paving-stone. Pittsburg and Alleghany are both supplied with water from the Ohio River, which is free from calcareous matter, and is distributed by iron pipes, after having been pumped up into reservoirs. Dr. Dickson treats many cases of urinary disease, most of his patients coming from Western Pennsylvania and Eastern Ohio. The great majority labor under the lithic acid diathesis, about ten per cent. under the phosphatic, and about five per cent. under the oxalic. The former have always dyspeptic troubles, and the phosphatic cases are usually associated with pulmonary disease, or lesion of the spinal cord, traumatic or idiopathic. The morbid states connected with the oxalic deposits have not been satisfactorily determined. Ten of the patients operated on by Dr. Dickson resided in Alleghany and Pittsburg, though several of them had had the complaint before they settled there.

Dr. W. C. Reiter, of Mount Pleasant, Westmoreland County, Pennsylvania, has found gravel and urinary deposits quite common in that region of country; in several instances, he has removed calculi by crushing. The valley in which he practises abounds in limestone, the water used by the inhabitants being strongly impregnated with that substance. By far the most common deposit is the lithic acid, which is often voided in considerable quantities, especially in old rheumatic subjects, in the form of sharp red sand. Dr. Reiter has never met with any cases of mulberry calculi. Upon the mountain, which incloses the valley just referred to, and where all the water is soft, the inhabitants are almost exempt from urinary deposits of every description.

Delaware.—Dr. James Couper, an eminent practitioner of Newcastle, informs me that calculous diseases are extremely rare in this State. He has been at great pains to collect the cases of stone in the bladder, and six are all that he has been able to find as having occurred during the last thirty years. The subjects were all whites, three having resided in the upper part of Newcastle County, a limestone district; one in the lower part of the same county; and two in Kent County. Four were children, one an adult, and one an old man. The population of Delaware, in 1850, was 91,532, of whom 18,000 were people of color.

Maryland.—No statistics have yet been published by the physicians of this State respecting the prevalence of stone in the bladder within its borders. There is reason, however, to believe that the disease is infrequent. I am led to this opinion by the fact, first, that many of the inhabitants use free-stone water, and secondly, by the circumstance that comparatively few cases of lithotomy and lithotripsy have occurred in the State.

Dr. Charles Frick, of Baltimore, so well known as the author of a work on urinary deposits, writes me that stone of the bladder is, in the main, comparatively a rare disease in that city and its vicinity. "I am sure," he remarks, "that I am very near the truth when I say that during the last ten years not more than fifty cases of urinary calculus have required an operation in the city of Baltimore, and some of these have been brought from Virginia and the interior of Maryland." Dr. John Buckler, who, perhaps, enjoys the most extensive medical practice in the State, has had, he thinks, on an average, annually, during the last fifteen years, only about six cases of renal and urethral calculi. Both he and Dr. Frick have found that the great majority of urinary concretions in Baltimore are composed either of uric acid or of oxalate of lime, the phosphatic varieties being very rare.

Dr. Frick states that, so far as he has been able to ascertain, urinary calculi are never seen among the poorer classes of Baltimore, and he refers, in corroboration of the truth of his statement, to the fact that during the three years in which he was a resident student of the Baltimore Almshouse, which averages annually about 700 inmates, not a single example of the disease was brought under his observation; nor have any cases been admitted since, a period of eight years. For the last four years, during which, moreover, he has been physician to the Maryland Penitentiary, he has not witnessed among the prisoners, who average 400 annually, an instance of stone in the bladder. Urinary deposits, however, are exceedingly common in all classes and conditions, and seem to be produced by the same causes as elsewhere.

Two years ago, Dr. Frick made a chemical analysis of the calculi extracted, at various times, by Professor N. R. Smith, of the University of Maryland, and consisting altogether of thirty-two separate specimens. The results were as follows: 4 of pure uric acid, 4 of pure urate of ammonia, 10 of pure oxalate of lime, 6 of phosphates, 2 of urate of lime, and 1 of pure cystine: 15 contained uric acid, either alone, or combined. The patients, however, from which these concretions were removed, were not all natives of Baltimore; some were from Virginia, and some from other Southern States, but in what proportion cannot be ascertained.

District of Columbia.—The District of Columbia, wedged in between Maryland and Virginia, and containing, in 1850, a population of nearly 52,000, has few calculous patients. Professor May, of Washington City, declares that stone in the bladder is exceedingly rare both there and in the adjoining regions. Altogether he knows of but five cases of lithotomy that have occurred at Washington; of these, three were operated on by himself, one by his father, the late Dr. John May, and the other by Professor Gibson, then of Baltimore, but now of Philadelphia.

Virginia.—All that portion of Virginia which lies east of the Blue Ridge, as it is termed, belongs to the freestone formation; limestone being found only in the western sections. Marl exists in nearly all parts of the former region, forming beds from a few feet to a hundred feet or more in depth. The water in the marl districts is not considered good drinking water.

Stone of the bladder appears to be common in Virginia. According to Dr. Mettauer, of Prince Edward Court-house, it is met with as often in one portion of the State as in another. "I am very certain," observes this distinguished surgeon,¹ "as far as my cases enable me to decide, that the disease is not more common in the limestone regions than in other sections of it; and, after carefully investigating the subject, I came to the conclusion, long ago, that the affection is not due to calcareous influences, but that it is the product of derangement of the general health, involving chiefly the digestive organs. This is certainly the case with adults, and even with younger subjects. Climate has not seemed to me to predispose to the malady, except in so far as a variable temperature may be concerned, and then only in a moderate degree, and in connection with rheumatism." "Persons of a strumous constitution are, I think, more obnoxious to calculus than those differently organized, especially if they have been affected with rheumatism, or if they have descended from rheumatic parents. Only three cases have occurred in the scope of my observation that appeared to be the immediate product of this class of diseases; and it is a little remarkable that two of them, namely, one male and one female, labored under distortion of the pelvis on the same side, and almost in the same degree, from repeated attacks of rheumatism. The calculi in both were the largest I have ever extracted, the weight of one exceeding thirteen, and of the other sixteen, ounces. Both patients promptly recovered." Dr. Mettauer has not been able to discover that modes of life have contributed, in any of the cases which he has witnessed, to favor the origin of stone in the bladder. In several of his infantile cases verminous irritation seemed to have induced the disease, although the vesical symptoms did not show themselves until many months after the subsidence of the alimentary affection. Finally, he has occasionally met with the malady soon after birth, leading him to believe that it is sometimes hereditary. The number of cases operated on by Dr. Mettauer is ninety-one, embracing nearly every age from three years to eighty-two. About one-fourth of his patients were blacks.

Dr. P. C. Spencer, of Petersburg, has reported to me the particulars of nine cases of the bilateral operation, which, together with 15 cases previously published by him in the *American Journal of the Medical Sciences*, for July, 1850, give a sum total of 24. Of this number 15 were whites, and 9 were blacks. Of the former 8 were boys; 4 were nearly grown, 2 were over 21, and 1 over 64; of the latter 6 were boys, and 3 were men, 1 being upwards of 61. The largest calculus which he removed was about the volume of a turkey's egg, and weighed nearly 5 ounces. Considerable sloughing of the cellular tissue and surrounding parts occurred, but the man made a very satisfactory recovery. The origin of more than one-third of the cases was traced back to their birth. All the patients were from the freestone regions of Virginia and North Carolina, and hence Dr. Spencer thinks that climate has less influence in the production of calculous disorders in those localities than food and water.

It will thus be seen that the two Virginia lithotomists have had an aggregate of 115 operations, of which 31 were in people of color, or in the proportion nearly of one black to four whites. Now, if it be remembered, that in 1850 the number of white inhabitants of this State was 894,000, and the number of blacks 526,000, it will be found that the latter are considerably less liable to stone in the bladder than the former; a circumstance for which, so far as I know, no one has yet assigned any satisfactory reason.

North Carolina.—The geological formation of North Carolina is very similar to that of Virginia. Limestone is found only in the more hilly and mountainous districts, while the more level regions consist of freestone. The portions bordering on the Atlantic are composed of alternating strata of sand and clay, belonging to the latest period of the secondary formation. Deposits of marl are not uncommon in many places; and along the coast white oceanic sand, destitute of organic remains, overspreads the surface.

From all that I can learn, calculous disorders are uncommon in this State.

¹ MS. letter to the author, August 29, 1854.

Dr. W. T. Howard, who has practised eleven years at Warrenton, and whose sphere of observation embraces not less than eight counties, is cognizant of but one case of stone that originated in that district, and that was operated on in Philadelphia in 1842. He has met with about a dozen instances of renal calculi, chiefly of the lithic acid variety; the patients were nearly all high livers, above forty years of age. Dyspepsia is not infrequent among the negroes, but Dr. Howard has not seen any examples of calculous disease among them. He has often seen cases of oxaluria, so well described by Dr. Frick, of Baltimore, and he thinks that the occurrence is much more common than is generally supposed.

Dr. James H. Dickson, of Wilmington, has in a practice of twenty-five years not met with a solitary case of stone, and he knows of but one instance of the disease during the same period in the practice of another physician. His experience, in this respect, entirely coincides with that of his professional confrères, who all testify to the infrequency of this complaint in that region of country. Dr. Dickson has also found renal calculus very uncommon; not more than six or eight examples having fallen under his observation during the above period. He is inclined to ascribe this remarkable immunity from calculous complaints to the influence of the geological formation of the part of the State in which he lives, as the habits of the people do not differ materially from those of the residents in the hilly regions of the interior, where such maladies are more common.

South Carolina.—Calculous affections are not of frequent occurrence in this State. In Charleston, they are, as I am informed by Dr. Ogier,¹ an eminent practitioner of that city, very rare. In the Charleston district and the lower country, as it is called, there are large quantities of marl, and the water no doubt contains much calcareous substance, but it is so impregnated with saline matter that it is in many places unfit for drinking purposes. Hence, in Charleston, cistern-water is used almost exclusively, while in many portions of the country river water is employed. In the middle and upper part of the State spring water is in general use. Dr. Ogier remarks that he has operated for stone four times; one of his patients being from North Carolina, one from Georgia, and one from South Carolina, at Hamburg, near the boundary line of the two latter States; the home of one not being recollected. Of the three, two were from limestone regions. The calculi in two of the cases were mulberry; in the other, the concretion consisted principally of phosphate of ammonia and magnesia. Dr. Eve² asserts that stone in the bladder is so rare in Charleston that, up to 1845, the operation of lithotomy had not been performed a dozen times in that city.

Dr. Smith, of Society Hill, finds calculous diseases of very infrequent occurrence in his section of country. The part of South Carolina in which he resides resembles, in its main geological features, the region of country around Wilmington, North Carolina.³

Dr. Thomas Wells, formerly of Columbia, South Carolina, informs me that calculous diseases are of infrequent occurrence in those parts of South Carolina, North Carolina, and Georgia with which he is professionally acquainted. During a residence of nearly thirty years at Columbia, he saw not more than twenty-five or thirty cases of stone in the bladder; and, what is remarkable, most of these occurred during the first half of that period, several being old cases which he found there upon his arrival. He performed the operation of lithotomy only ten or twelve times. Most of the concretions which he removed were composed of lithate of ammonia and phosphate of lime. He thinks that there is nothing peculiar in the geological formation of that section of the country to favor the production of calculous complaints; in most of his cases the cause seemed to be derangement of the digestive functions. Three of his patients were very young, being less than three years old. Two were foreigners: one, a medical gentleman, aged sixty-five, was from Ireland, and the other a boy, aged forty-five, was a native of one of the West India Islands.

¹ MS. letter to the author, Nov. 16, 1854.

² Amer. Journal Med. Sciences, N. S., vol. xxiv. p. 42. 1853.

³ Dr. James H. Dickson, MS. letter to the author.

Georgia.—Georgia has furnished a number of cases of urinary calculi, but these formations, as I am told by Professor Dugas,¹ of Augusta, are not common in any portion of the State. He is of opinion that they are much more prevalent in the regions of primary geological structures than in those which extend from these to the sea board. Professor Eve,² of Nashville, also asserts that calculous disorders are infrequent in Georgia. At Augusta, in that State, where he resided a number of years, the operation of lithotomy had not been performed until 1841, and up to 1845 the operation, it would seem, had not been required at Savannah.

Dr. P. E. L. Jennings, of Lagrange, has reported to me eight cases of stone which occurred, during the last seven years, in Troup and Coweta counties; and, what is remarkable, there is no limestone in either of these localities. Of these cases, which were operated on by Dr. Eve, Dr. Dugas, Dr. Wildman, and himself, seven were white male children under twelve years of age, and the other was a white adult man. In two of the children there was a recurrence of the disease.

Florida.—Of the occurrence of calculous diseases in Florida we are entirely ignorant; no attempt has yet been made to investigate the subject, and I am not aware that a solitary case of native origin has ever been reported in our medical journals. The population, which is, at present, a little over 100,000, is subject to the same diseases as that of the adjoining States of Georgia and Alabama, in whose geological features Florida strongly participates.

Alabama.—Most of the cases of stone in the bladder in Alabama occur in the northern part of it. Unfortunately, however, no statistics have yet been collected in regard to the relative frequency of this complaint in different sections of the State. Dr. Dudley is said to have had a number of cases from that region, but how many I am not informed.

Dr. J. C. Nott,³ of Mobile, makes the following remarks relative to the prevalence of calculous diseases in the region of country where he resides: "I have been in Mobile nearly twenty years, and during that time I have operated upon all the cases, except one, that have occurred in this city, or have been brought here. The number of cases amounts to twelve, embracing all ages from two years to twenty. About one-third were negroes, and all, except one, were brought from the interior counties of the State." Dr. Nott adds that calculous affections are very rare in South Alabama. The truth of this statement is corroborated by my friend and former pupil, Dr. Bozeman, of Montgomery, who assures me that this class of diseases is less common than any other in the whole State. He thinks that there are but three physicians in all that country who have ever performed the operation of lithotomy. Dr. Gill, of Tuscaloosa, has found calculous deposits rather frequent in his portion of the State; but he has rarely met with stone in the bladder.

Louisiana.—Calculus in the bladder is infrequent in Louisiana. Professor Stone, who has practised twenty years at New Orleans, has operated only eight times for the relief of this disease. His opinion is that calculous affections are rare in that section of the south. In addition to these cases, Dr. A. Mercier states that eight others have occurred in the hands of different physicians since 1830, making in all, with two cases observed by Dr. E. D. Fenner, who has kindly communicated to me these facts, about eighteen cases. It is to be remarked, however, that some of these cases were brought from Mississippi, and perhaps also from other regions.

Of Dr. Stone's cases I have not been able to obtain any particulars, except that they all, save one, recovered. Eight cases, treated by Dr. T. Tricon, De Valetti, Durel, Delery, Guesnard, Luxenberg, Boulon, and Mercier, also recovered. The patients of Dr. Fenner were not subjected to operation. The ages of the ten patients varied from two years to sixty. Two of the patients were negroes. Dr. De Valetti performed the high operation in one instance, and extracted an enormous stone. The result of the case is published in the *New Orleans Medical and Surgical Journal*. Dr. Cartwright, who, as has been stated

¹ MS. letter to the author, Oct. 5, 1854.

² Amer. Journ. Med. Sciences, N. S., vol. xxiv. p. 42. 1852.

³ MS. letter to the author, Sept. 2, 1854.

elsewhere has practised medicine in Louisiana for thirty-five years, considers stone in the bladder as among the rarest diseases of that State. He has never witnessed an example of it in the negro race, and very few among the whites.

Texas.—While Texas we are hardly sufficiently acquainted to enable us to form any opinion respecting the occurrence of calculous disorders within its borders. I have reason, however, to believe, from the numerous inquiries which I have made on the subject, that it is very uncommon. My friend, Dr. S. A. Watkins, who has resided in that country for some years, and who has an intimate acquaintance with its diseases, has never seen a case of stone in the bladder, nor has he ever heard of one which originated there. His observations extend over a large district, embracing the cities of Houston and Galveston, and a population of upwards of 30,000; the country is low and flat, with a sandy soil, and the water percolates through a bed of white sand, from fifteen to twenty feet in depth. In the cities, cistern water is almost exclusively used both for drinking and culinary purposes.

Mississippi.—I have made inquiries of many physicians of this State, and their concurrent testimony is that calculous disorders are very infrequent. But few patients are brought thence to Kentucky for operation, and thus far we have not produced any distinguished lithotomist. The late Dr. Halsey, of Vicksburg, operated oftener than any other surgeon in that country, and he, as I am told by Dr. Fenner, had only five or six cases altogether.

Alabama.—More than one-half of this State abounds in the freestone formation, and I have learned from numerous and reliable sources that stone in the bladder is almost unknown among its citizens, who now, in all probability, number nearly 500,000.

Tennessee.—This State, next to Kentucky, probably furnishes a larger number of cases of stone in the bladder than any other section of the Union. Unfortunately, however, no statistics have yet been published respecting the absolute and relative prevalence of this disorder, and hence everything like a positive statement on the subject is out of the question. It would be interesting to know how many of the 207 patients operated on by Dr. Dudley were from this State; but here, again, our information is sadly at fault, as that distinguished surgeon has neglected to keep a record of the locality of his cases. Of the 40 cases operated on by myself, only 5 were from Tennessee. Dr. Eve¹ states that since his residence at Nashville, a period of less than four years, he has been consulted in about 50 cases of stone, very few of which, however, had been lithotomized. Dr. W. T. Briggs, of that city, has had six cases; Professor Buchanan probably a dozen.

The late Dr. Beeton, of Murfreesboro', Rutherford County, Tennessee, operated on 7 cases; and Dr. B. W. Avent, of the same town, informs me that he has had 3 cases. My colleague, Professor Yandell, during his residence in that country, lithotomized 4 patients.

Cases of gravel or calculous deposits, are common throughout the State. In Western and Middle Tennessee, in particular, these disorders are very frequent. The most common deposits are the lithic acid and urates of ammonia.

Calculus of the bladder appears to be particularly common in certain sections of this State, where there is an entire absence of limestone. Thus, in Carroll County and its vicinity, West Tennessee, nine cases of the disease have occurred, although none but the softest water is used by the inhabitants. Dr. D. W. Yandell, to whom I am indebted for this information, has, within the last few years, operated upon four of the patients, of whom three were children. Allusion has already been made to a similar circumstance in regard to Troup and Coweta Counties, Georgia. Kentucky and some of the other States furnish similar evidence of this occurrence.

On the other hand, the disease would seem to be very infrequent in certain parts where there is no freestone. Thus, in Knox and Anderson Counties, the inhabitants of which use none but hard water, there have been, according to Dr. W. J. Baker, but two cases of vesical calculi, during the last twenty-

¹ Nashville Journal of Medicine and Surgery, vol. vii. p. 2, 1864.

eight years. In Knoxville, the capital of the former of these counties, there has not, during this period, been a solitary example of the malady, in a population which has been gradually increasing from 2,000 to 5,000.

The above facts are extremely interesting, as they furnish strong arguments against the opinion, so often and so confidently expressed, that calculus of the bladder owes its origin to the use of limestone water.

The following facts relative to the nature of the Tennessee calculi have been kindly furnished me by Dr. E. B. Haskins, to whose labors reference has already been made in another part of this work. The number of specimens analyzed by him was 176, of which 107 were duplicates.

The weight of the concretions ranged from 2 grains to 1,027, the average being 91 grains, and the aggregate 16,038.

The specific gravity of 45 specimens only was taken, the lowest result being 1.198, and the highest 1.812, with an average of 1.509. Of this number, there were of

Earthy phosphates,	9,	with an average specific gravity of	1.338.
Urates	5,	"	1.604.
Oxalate of lime	1,	"	1.689.
Mixed	30,	"	1.538.

Chemical Results.—The whole number of calculi analyzed was, as already stated, 176, 107 being duplicates, leaving thus 69 separate specimens. The results are arranged with reference to the nuclei and bodies of the concretions.

1.	Predominance of the urates ¹ in the nuclei,	48,	3 being duplicates,	45
2.	" " oxalate of lime	" 20,	6	14
3.	" " triple phosphate	" 101,	95	6
4.	" " phosphate of lime	"	"	2
5.	" " uric acid	" 4,	3	1
6.	" " foreign matter	"	"	1
				<hr/>
				69

The number of *simple calculi*, or nuclei without bodies, if such an expression be allowable, was 44. The number of compound concretions, or those having a body upon a nucleus, was 132, of which 78 were duplicates, leaving 54 separate specimens.

1.	Predominance of urates in the bodies	8
2.	" of triple phosphates in the bodies, 93, 75 being duplicates,	18
3.	" of oxalate of lime " " " "	15
4.	" of phosphate of lime " " 15, 3 " "	12
5.	" of uric acid " " " "	1
		<hr/>
		54

The *compound calculi*, or those having both a body and nucleus, may be arranged as follows with regard to the chemical relations of their grand component parts. The entire number was 54.

I. Number of specimens in which urates predominated:—		
1.	Number of calculi having nuclei of urates	8
II. Number of triple phosphate bodies, 93, 75 being duplicates:—		
1.	Number having nuclei of triple phosphate, 76, 75 " "	1
2.	" " " of " urates	12
3.	" " " of " oxalate of lime	5
		<hr/>
		18

¹ Dr. Haskins uses the term "urates," instead of "urate," of ammonia, because he has never found this substance to exist in any other form than in combination with urate of lime or of soda, or both.

III. Number of phosphate of lime bodies, 14, 2 being duplicates:—

1. Number having nuclei of urates	7
2. " " " of triple phosphate 4, 2 "	2
3. " " " of oxalate of lime . . .	3
	<hr/> 12

IV. Number of oxalate of lime bodies:—

1. Number having nuclei of oxalate of lime . . .	2
2. " " " of urates . . .	12
3. " " " of foreign matter . . .	1
	<hr/> 15

V. Number of uric acid bodies:

1. Number having nuclei of urates . . .	1
	<hr/> 84

By comparing these results with those obtained by Dr. Peter, in his examination of the calculi in the Museum of the Transylvania University at Lexington, it will be seen that they exhibit a very close approximation. Thus, excluding the duplicates in both cases, as is necessary in order to place the subject in its true light, we shall have 71 Kentucky specimens, and 69 Tennessee. Of the former, the nuclei in 6 were composed nearly entirely of uric acid, and in 8, of earthy phosphates; in the latter, of uric acid in 1, and of earthy phosphates in 8.

Bases of the Urates.—Dr. Haskins analyzed 84 specimens of the urates, with a view to determine their bases, and the results arrived at were as follows: Ammonia was found in all; lime with ammonia in 83; soda with ammonia and lime in 55; and soda with ammonia alone in 1. For magnesia and potash no search was made. It may be stated, as a curious fact, that the ammonia largely predominated over both of the other constituents. Urate of lime, which has generally been regarded as a rare ingredient of urinary calculi, was present, as just stated, in 83 of the examinations, and usually existed in larger quantities than the soda.

Kentucky.—In Kentucky, stone in the bladder is probably more common than in any other section in the Union. A very large majority of the cases operated on by Dr. Ephraim McDowell, Dr. Dudley, Dr. Goldsmith, Dr. Gardner, Dr. J. M. Bush, myself, and others, amounting to nearly 400 in all, were from various portions of this State. Dr. Dudley's cases came from all parts of the State, except the sandstone regions; but the largest proportion were from the counties bordering on the Licking River, and abounding in blue limestone, which imparts its distinctive characters to the water habitually used by the citizens of those districts. Of 40 persons cut by myself, 27 were from various parts of Kentucky, chiefly the carboniferous regions. Dr. Gardner, of Woodsonville, has lithotomized 15 persons, most of whom were from the counties immediately around his own residence, as Hart, Barren, Warren, and Green. All, save two, had been in the habit of drinking limestone water, and all, except four, were under twenty years of age. Of Dr. Dudley's patients, three-fourths were under fifteen years; and of the 27 Kentucky cases in my own practice, 14 were under this age.

No examinations, on an extended scale, have yet been made of the Kentucky calculi; unfortunately, many of those extracted by Dr. Dudley have been lost. Those that have been preserved, as well as some others contained in the Lexington collection, have been analyzed by Professor Peter, an outline of whose researches, prepared for me by Mr. Thomas E. Jenkins, of this city, is herewith subjoined.

The number of concretions examined was 106, of which 35 were duplicates, leaving thus 71 separate specimens. The results are arranged with reference to the nuclei and bodies of the calculi.

1.	Predominance of the uric acid in the nucleus in 36, 30 being duplicates	6
2.	" urate of ammonia " 41, 3 "	38
3.	" oxalate of lime " "	14
4.	" earthy phosphates " "	8
5.	" cystine " 3, 1 "	2
6.	" foreign substance " 4, 1 "	8
		<hr/> 71

Simple Calculi: whole number 31.

1.	Predominance of uric acid in the concretion	.	.	.	.	5
2.	" urate of ammonia in the concretion	.	.	.	.	9
3.	" oxalate of lime " "	.	.	.	.	9
4.	" earthy phosphates " "	.	.	.	.	6
5.	" cystine " "	.	.	.	.	2
						<hr/> 31

Compound Calculi: whole number 40.

I. Number of specimens in which uric acid predominated:—						
1.	Number of calculi having a nucleus of uric acid	.	.	.	.	1
II. Number of specimens in which urate of ammonia predominated:—						
A. Nucleus of urate of ammonia—						
1.	Bodies principally oxalate of lime	.	.	.	.	10
2.	" " urate of ammonia	.	.	.	.	7
3.	" " uric acid	.	.	.	.	3
4.	" " fusible	.	.	.	.	9
						<hr/> 29
III. Number of specimens in which oxalate of lime predominated:—						
A. Nucleus of oxalate of lime—						
1.	Bodies principally phosphates	.	.	.	.	2
2.	" " uric acid	.	.	.	.	2
3.	" " urate of ammonia	.	.	.	.	1
						<hr/> 5
IV. Number in which earthy phosphates predominated:—						
A. Nuclei of earthy phosphates—						
1.	Bodies principally phosphate of lime	.	.	.	.	1
2.	" " fusible	.	.	.	.	1
						<hr/> 2
V. Number in which fusible phosphates predominated:—						
A. Nuclei of foreign substances—						
1.	Bodies triple phosphates, phosphate of lime and urate of ammonia	.	.	.	.	1
2.	Bodies fusible, trace of uric acid and urate of ammonia	.	.	.	.	1
3.	Bodies fusible	.	.	.	.	1
						<hr/> 3
						<hr/> 40

The conclusions arrived at by Dr. Peter, are, first, that calculous diseases are more frequent in the limestone than in the freestone regions of Kentucky; and, secondly, that there is a larger proportion of phosphatic and oxalate of lime deposits, with a greater number of nuclei of urate of ammonia, and fewer of pure uric acid, in the limestone than in the freestone districts of the State, or where the water is free from calcareous matter. My own collection comprises about one hundred specimens, of which no analysis has yet been made.

The relative frequency of stone in the bladder, in different sections of the State, has not been ascertained. At Lexington, the ratio, according to Dr.

Peter,¹ is as 1 to 16,050. The average population of that city, during the last thirty years, prior to 1846, was 5,885; within that period Dr. Dudley had 11 cases of the disease, three in men and eight in boys, one of the latter being a negro. During the last fourteen years the disease, it would seem, has greatly diminished; so that the annual proportion has been only about 1 in 47,000; a proportion much less than that of Copenhagen, Norwich, and some other portions of Europe.

In Louisville, the metropolis of Kentucky, stone in the bladder is not, so far as my information extends, of frequent occurrence. Since 1830, the population has been gradually increasing from 10,000 to 70,000, and during that period only about ten cases of the malady have been observed among our residents. Of these, only six have been lithotomized, namely, one by Dr. Goldsmith, now of New York; one by Dr. William H. Donne; and four by myself. Other cases may have originated here, but I have not heard of any. Now, if we add five supposititious cases to those just referred to, we shall have an aggregate of fifteen, which are probably as many as have occurred during the period here specified. Estimating, as we reasonably may, the mean annual population of the city during the last twenty-five years at 40,000, we shall thus have one case of stone in about 66,500 inhabitants; a proportion four times less than that of Lexington. Our German population is upwards of 20,000, and, during the whole of my residence in Louisville, now fourteen years, I have seen or heard of but one case of vesical calculus among them. Of the ten cases of stone alluded to above, all except two occurred in children under ten years of age. Two of the number were blacks.

It is impossible to determine why stone in the bladder should be less frequent at Louisville than at Lexington, since our citizens drink the same kind of water, breathe the same atmosphere, eat the same kind of food, and are subject to the same diseases. Our water is strongly impregnated with calcareous matter, and is derived from deep wells, which exist in great numbers in every part of the city. The prevalent diseases are intermittent and remittent fevers, bowel complaints, dyspepsia, neuralgia, and rheumatism. The German emigrants consume large quantities of beer; the Irish drink an abundance of whiskey; and our native citizens are not sparing in the use of brandy.

Missouri.—In the former edition of this work, I placed Missouri among those States which are "comparatively exempt" from calculous affections. Dr. Pope, Professor of Surgery in the St. Louis University, whose position and experience entitle his opinion upon the subject to much weight, in alluding to this remark, in a letter recently received from him, holds this language: "I am inclined to think that hitherto this was true rather on account of a sparse population than any peculiarity of climate or locality. Urinary calculi are not, perhaps, as often met with here as in Kentucky, Tennessee, and Ohio, yet they are sufficiently frequent now, and we can scarcely claim to be even 'comparatively exempt.'"

Dr. Pope states that he has operated for stone fifteen times during the last twelve years. Three of his patients resided in St. Louis; the rest were from Missouri, Illinois, and the Rocky Mountains. In two, the disease was congenital, and in all, except one, it affected the male sex. The late Dr. Beaumont occasionally cut for stone in the bladder; and Dr. Pope thinks that Dr. McDowell, Professor of Surgery in the University of Missouri, may have operated fifteen or twenty times during his residence in that State. The population of Missouri, at the census in 1850, was 682,000, including nearly 60,000 people of color.

Most of the concretions removed by Dr. Pope were of the phosphatic variety, and next in point of frequency were the mulberry. He has six hemipedal calculi taken from one individual. About one-half of his patients were in the habit of drinking limestone water, and the other half freestone water. All recovered, except one, who died of cholera twenty-five days after the operation, and before he had recovered from its effects. His youngest patient was under two, and the oldest over sixty, years of age. St. Louis has a large German

¹ *Western Lancet*, vol. v. No. 4. 1844.

beer-drinking population, but Dr. Pope does not find that calculous complaints are more common among them than among those who do not use malt liquors.

Illinois.—This State has, thus far, furnished only a few cases of stone in the bladder; a circumstance so much the more remarkable when it is remembered that the inhabitants generally use water strongly impregnated with calcareous matter. Dr. John F. Henry, of Burlington, Iowa, who resided for a number of years at Springfield, the capital of Illinois, never saw or heard of a case of urinary calculus in that region of country; and the result of the experience of his son, Dr. G. R. Henry, is precisely to the same effect.

Professor Brainard, of Chicago, has noticed but few cases of stone in the bladder during his residence in that city. "My experience," he says, "in calculus of the bladder is limited, compared with that of Kentucky surgeons, the disease with us being rare, although the country is a limestone region."

Dr. Thompson, who has lived for many years at Albion, Edwards County, has seen only one case of stone in the bladder within the range of his practice, which extends over a considerable distance. The country is destitute of limestone, the subsoil being a hard clay face, and the solid rock sandstone. In the northwestern parts of the State, the limestone formation predominates; but the disease is, nevertheless, of infrequent occurrence. "Our Medical Journal," says Dr. Thompson, "contains no records of cases or operations, and in my personal inquiries among my friends I cannot hear of any."

Dr. S. York, of Paris, Edgar County, has practised medicine for the last twelve years, and during all this period there has not, he assures me, been a single case of lithotomy among any of the citizens of Eastern Illinois; nor has he himself met with any instances of calculous disease. The maladies of the country are such as prevail in malarious regions generally; and cholera never appeared there until 1851, and then not severely.

Dr. N. B. Chambers, of Peoria, says that calculous diseases are extremely rare in Illinois. This town, which is situated on the Illinois River, and contains a population of upwards of 12,000, has never furnished a case of lithotomy, nor has the operation ever been performed upon any one in the surrounding country. Most of the water used by the inhabitants is impregnated with lime, though, probably, in a less degree than in some of the other regions of the west.

Dr. Daniel Stahl, of Quincy, in a practice in Illinois of nearly twenty years, has never seen an instance of stone in a citizen of that State; nor has he during that time witnessed more than three or four cases of gravel and nephritic colic. Dr. J. N. Ralston and Dr. A. Nichols, also of the same town, have never, during a still longer period, met with the disease. The former, however, has had several examples of renal calculi, which were discharged by the urethra. Dr. L. Watson, in an extensive practice in the State of fourteen years, has seen only three cases of stone in the bladder, one of which occurred in a female who was operated on at St. Louis. The inhabitants of the western parts of Illinois use mostly well and spring water, impregnated with the salts of lime, and are subject to the same diseases as the citizens of Missouri, Indiana, Kentucky, and Ohio.

Illinois is almost throughout her whole extent one vast plain, consisting of extensive fertile prairies, with here and there a belt of woodland, chiefly along the watercourses. The soil is a black loam, from six inches to three feet in depth, underlaid with a tough yellow clay, containing a considerable amount of gravel and limestone. But few coal beds exist in Eastern Illinois. Well water, which, in many places is strongly impregnated with calcareous matter, is used almost exclusively by the inhabitants.

Indiana.—Indiana, partaking of the same geological features as Kentucky, Ohio, Illinois, and Tennessee, furnishes comparatively few cases of stone in the bladder. Limestone prevails throughout the State; and water, strongly impregnated with that substance, is freely used for drinking and culinary purposes. The whole southern portion is underlaid by fields of bituminous coal; the bayou lands there are extensive, and contain vegetable salts in great abundance. The inhabitants generally throughout the State employ large quantities of imperfectly fermented wheat bread, corn bread, and meats, espe-

cially pork and poultry. Distilled liquors are liberally consumed in certain localities, but more sparingly in others. Malt liquors are used only in the larger towns. The prevalent diseases of Indiana are intermittent and remittent fevers, dyspepsia, neuralgia, and rheumatism; affections of the liver are also common.

Dr. Bobbs, of Indianapolis, affirms that stone in the bladder is among the rarest surgical maladies in the State. This opinion, he says, accords with that of many of the physicians who reside in the interior; adding that, if there be any exception to it, it is in relation to some of the counties bordering on the Ohio River. Sabulous deposits, both crystalline and amorphous, on the contrary, are not uncommon, especially in elderly subjects of impaired health. Of these the uric acid and its compounds are by far the most frequent, and they often exist to such an extent as to become a source of great annoyance both to the patient and his medical attendant.

Dr. Bray, of Evansville, who has been a resident of the southern portion of Indiana for about twenty years, informs me that calculous deposits are common in that region, but that stone in the bladder is rare. Of 40 cases of this disease operated on by myself since my residence in Louisville, 4 were from Indiana. Some of Dr. Dudley's and Dr. Mussey's cases have also been from this State; but only in a very limited proportion.

Dr. B. F. Mullen, of Napoleon, Ripley County, has given me the particulars of three cases of stone in the bladder which have originated in that region during the last fifteen years. The inhabitants make free use of limestone water. In the adjacent counties of Decatur, Dearborn, and Jennings, where the same kind of water is found, no instance of the disease has ever been known.

In New Albany, the metropolis of the State, only five cases of stone in the bladder have, according to Dr. A. Clapp, occurred during the last thirty-seven years, and of these only two were among natives. During that period there has been one death from renal calculi. The population of the city was about 4,000 in 1835, and is now nearly four times that size. The inhabitants use limestone water exclusively for drinking and cooking purposes. Dr. Clapp is of opinion that stone in the bladder is rare in Indiana.

Ohio.—This State, in the number of its stone cases, is perhaps only excelled by Kentucky, Tennessee, and Virginia. No statistics, however, upon an extended scale, have yet been furnished in illustration of the subject. From the "Report on Calculous Diseases, in Ohio," made to the Ohio State Medical Society, at its annual meeting at Columbus, in June, 1850, by Dr. E. H. Davis, it appears that 74 persons had been operated on for stone in the bladder, in different sections of the State: 72 by cutting, and 2 by crushing. Of this number, 6 died, and 2 were subjected to the knife a second time. In addition to these cases, there were 13 others, as ascertained by dissection, and 64 who passed sand or gravel; making the sum total of 151.

The report of Dr. Davis embraces only forty counties, and the time to which the statistics relate varied in the different counties, from five to twenty years. According to the census of 1840, the population of these regions was about 900,000, or three-fifths of the entire State. If we now add, as suggested by Dr. Davis, twenty-five per cent. for the deficiency in the returns, upon which his report is based, we shall have, estimating the average population of Ohio for the last fourteen years at 1,600,000, about 12 cases of stone a year, or 1 operation in 135,000 inhabitants.

The disease would seem to be by far most common in those parts of the State which abound in limestone. Thus, in eighteen counties, embracing those along the Scioto Valley, with a population of nearly 400,000, and an average time of observation of twelve years, the number of cases, as ascertained by operation and dissection, amounts to 56. Adding one-fourth to complete the returns, there will be 1 case annually to about 60,000 inhabitants; while, on the other hand, the twenty-two counties in the sandstone and coal series, with a population of 552,000, and an average time of observation of sixteen years, furnish only 30 cases of stone, 28 by operation, and 2 by dissection. Adding one-fourth for the supposed deficit, there will thus be 1 case annually to 238,000

persons; or nearly one-fourth less than in the limestone districts. The disease would also seem to be more frequent in the blue limestone than in the cliff limestone regions.

Cincinnati appears to be remarkably exempt from stone in the bladder, there being, according to the report in question, only 1 case annually in 80,000 inhabitants. In Columbus, on the contrary, there is 1 in 30,000, and in Dayton, 1 in 25,000. This difference is easily explained, Dr. Davis thinks, by the fact that Cincinnati derives her supply of water entirely from the Ohio River, which is but slightly impregnated with calcareous matter.

The calculi, hitherto removed and examined, differ little, if any, in their general character, from those found in Kentucky. The concretions in the collections of Mussey, Howard, and other surgeons, consist principally of the phosphates of lime and magnesia, with but few specimens of the pure uric acid and mulberry varieties.

Michigan.—In relation to calculous affections in Michigan, the following facts have been kindly furnished me by Dr. Zina Pitcher, of Detroit, whose reputation as a scholar and a scientific physician, is well known to the profession. It is proper to premise that his remarks are intended to apply more particularly to that part of the State called the lower Peninsula of Michigan; as that portion of it bordering on Lake Superior at the time he was most familiar with that region was then inhabited only by Indians, a few white persons who were concerned in the Indian trade, and the troops necessary to garrison the forts at Mackinac and the Saut de Ste. Marie.

The country here referred to is very level, and its geology, therefore, easy of comprehension. About one-half of the State, embracing its outer border or water-worn margin, consists of the upper Silurian formation, which is, for the most part, composed of fossiliferous limestone. The central portion is underlain by Devonian and carboniferous rocks, which are mostly shales and sandstones. These formations are covered by a heavy deposit of drift, so that the rocks seldom appear on the surface.

The sand, gravel, and boulders, composing the drift deposits, are greatly intermixed with limestones and lime pebbles, and hence the water, in most sections, is impregnated with calcareous matter. The country to which these remarks apply lies between the forty-first and forty-sixth degrees of north latitude, and is bounded on the east and west by Lakes Huron and Michigan. Within these limits, which, in 1850, contained a population of about 400,000, the operation of lithotomy has never been performed but twice, and in both instances upon very young subjects.

Although calculous disorders rarely occur in Michigan, still, Dr. Pitcher has occasionally met with them under the following circumstances: 1. In children, from a few months to three years old, who have suffered from such derangements of the digestive organs as produce attacks of lithiasis; 2. In pregnant females, with feeble powers of assimilation, in whom the triple phosphates are more liable to form; 3, and lastly, there is another class of individuals, now fast becoming extinct, who, having adopted the social habits of such of our European ancestors as formerly held military possession of this country, suffered from gout and the stone, in consequence of their addiction to the daily use of wine, as still do the gentlemen of the country from whom these social habits were derived.

The acquaintance of Dr. Pitcher with the diseases of the country under consideration commenced more than thirty years ago, twenty of which he has spent at Detroit; and during all this period, notwithstanding the above remarks, he has not seen, it would appear, more than half a dozen of each of these varieties of gravel and stone. When he settled at Detroit, he found there a surgeon who had served in the army of General Wayne, which took possession of that city in 1796. Neither he, nor any of his citizen contemporaries have left any traditionary or written account of any cases of lithotomy which had their origin in the old Northwest Territory.

The descendants of the early French inhabitants of this country are subject to deposits of phosphate of lime in the arterial tissues, which Dr. Pitcher supposes to be connected with their mode of living, and he refers to the fact as an

illustration of the influence of diet in the production of phosphatic deposits in other organs than the kidneys. It may assist, he thinks, in the establishment of some general prophylactic rule, or in the confirmation of some practical precept, already known. These people, who have generally inhabited the borders of the navigable rivers, are ordinarily frugal livers, but use a large proportion of wheat bread made of the finest flour, in which phosphate of lime is always an ingredient.

"A fact," says Dr. Pitcher, "which came under my notice, during my residence at Fort Brady in 1827, I regarded as so instructive at the time, both in relation to the cause of that particular case, and the remedy for analogous ones, that I am tempted to narrate it even now. Mr. B., who had previously to this period made free use of animal food, had at times suffered from attacks of acute rheumatism and also of gravel, during which he passed considerable quantities of red sand. During the winter of that year he was stationed, as an Indian lyed-corn trader, on the shore of the lake, near the present mining district on Lake Superior. The ice was in such a state that they could not fish, and the party, with Mr. B. among them, were obliged to subsist on lyed-corn and Indian sugar. From this time his attacks of gravel ceased, and had not returned a few years after, when I was ordered to a southern station."

Dr. Pitcher is unable to speak of the relative prevalence of diseases of the urinary organs in this particular class, in opposite sections of the country, because the troops with whom he was stationed while in the south were, like himself, temporary residents in that portion of the Union.

The inhabitants of Michigan, from its first settlement to the present time, have been more or less liable to the diseases imputed to malaria, varying in degree with the character of the season. There is nothing in their mode of living remarkably characteristic. Out of the cities and villages malt liquors are not much used. Wine is not a common drink. Cider is not yet very extensively manufactured. The abundance of wheat enables every one to use it if he choose.

Iowa.—This State, with a population of nearly 300,000, has presented but few cases of stone in the bladder. One of my former pupils, Dr. G. R. Henry, of Burlington, has never seen an instance of the disease in that town and in the surrounding country; nor has his father, who has been in practice there for many years, been more fortunate. At a meeting, however, of the Iowa State Medical Society in June, 1854, the Committee on Surgery reported a case of stone in the bladder of a woman, operated on by a German physician at Muscatine; and a few years ago a man of the name of Reese, of that town, visited me on account of a similar affection, brought on by external injury received about fifteen months previously. Professor J. C. Hughes, of Keokuck, is cognizant of six cases of stone, all of them of native origin; four occurred in males, and two in females. Of these cases five were operated on by the lateral method, and one by the bilateral; one of the former having died. Dr. Hughes is of opinion that the disease is very infrequent. Dr. Finley, of Dubuque, another of my private pupils, has been engaged in extensive practice at that city for seventeen years, and during all that time he has heard of but one case of stone in the bladder, and that was an imported one. Limestone abounds throughout Iowa, and of course limestone water is largely used by the inhabitants. The prevalent diseases are of a miasmatic character.

Wisconsin.—The remarks which I have just made in reference to the prevalence of stone in the bladder in Iowa, are equally applicable to this State. The disease, from all I can learn, is quite uncommon.

UNITED STATES NAVY.

For the following facts respecting the occurrence of stone in the bladder, among the sailors in the service of our government, I am indebted to my learned friend, the veteran surgeon, Dr. W. P. C. Barton, formerly at the head of the Medical and Surgical Bureau, at Washington. His communication, which is based upon an experience of many years, and which is accompanied by the testimony of a number of his colleagues, tends to show that this disease is

almost unknown in our seafaring people, both men and officers. "I have been surgeon," says Dr. Barton, "of the Norfolk Hospital, the Pensacola Hospital, and the Naval Asylum for Pensioners, at Philadelphia, but have never met with a single case of calculous disorder. The same remark is true in regard to the Navy Yard, at Philadelphia, the sick of which I have attended for many years. In short, from all the light which I have been able to obtain upon the subject, I am induced to believe in the entire immunity of this class of individuals from stone in the bladder."

Dr. J. M. Foltz, who has been in the navy twenty-four years, one-half of this period being at sea, on board our largest vessels, has never met with a case of stone in a sailor. He has observed urinary deposits in landsmen and marines, but never in an individual who had been brought up at sea, and who had passed his time on board ship.

Dr. W. S. W. Ruschenberger states that his experience in a naval career of twenty-eight years, goes to confirm the opinion of Dr. Barton, in regard to the infrequency of stone in the bladder among seafaring people. He adds that he once extracted a calculus from the urethra of a seaman, on board the Plymouth.

Dr. James M. Green, who has been in the navy thirty years, has never met with an instance of stone or gravel in an officer, sailor, or marine. Within the last thirteen years he has been Surgeon of the Fleet of the Home and Pacific Squadrons, and in the numerous reports of the different intelligent medical officers during that period, no mention, he says, is made of the existence of calculus in the bladder or kidneys. Dr. Samuel Barrington, in speaking of this subject, affirms that he has never met with an instance of vesical calculus. Dr. G. R. B. Horner, who has been many years in the navy, has never witnessed the affection among sailors, and his opinion is that they enjoy an exemption, if not a positive immunity, from it. Dr. James Cornick, of the U. S. Naval Asylum, at Philadelphia, has seen only one case of stone, which he removed by the lateral section in 1853. The patient, a man aged 26, had been in the service about six years; and the concretion weighed thirteen drachms, although no characteristic symptoms were noticed until a short time before the operation. "This," says Dr. Cornick, "is the first case I have met with or heard of in the navy, and I am disposed to think it the only one that has occurred in it."

To what this immunity from calculous disease in the navy is owing, we have no means of determining. It is a singular fact that it should exist in the seafaring people of all nations. One reason undoubtedly is, at least so far as it respects our government, that all recruits are sound when admitted into service; and another, the circumstance that great care is bestowed upon the preservation of their health, by allowing them, both while ashore and afloat, a good supply of wholesome food, and an abundance of exercise.

In a list of fifteen cases of lithotripsy and lithotomy, sent me by Dr. J. M. Warren, is the name of an American citizen, aged 25, who contracted the disease at sea. The concretion, which was of a phosphatic character, had formed around a bit of sealing-wax bougie introduced some month's previously for the relief of stricture. In the section on diagnosis, p. 489, is mentioned an instance of stone in the bladder of a captain in the merchant service; but whether it originated at sea or in consequence of the frequent voyages made by the gentleman, it is not in my power to affirm.

§ 2.—PREVALENCE OF STONE IN THE BLADDER AND CALCULOUS DISORDERS IN CANADA AND NOVA SCOTIA.

In regard to calculous diseases in Canada West, Dr. N. Bethune, an eminent practitioner of Toronto, has politely communicated to me the following statement: "My own impression," he says, "always was that this class of affections was very infrequent, and such, in fact, I find, upon inquiry, to be the case. I recollect having seen but four or five operations for stone at Toronto, and the majority of these were performed upon children under twelve years of age:

one of them upon an infant from the neighboring State of New York. Of course, there have been others, unknown to me; but the experience of medical men in this city goes to show that diseases of this description are comparatively rare."

I regret that my space will not permit me to give, at length, the interesting and valuable abstract which accompanies Dr. Bethune's communication on the geology of Western Canada. A few extracts must suffice.

The whole of the present inhabited portions of Western Canada is deeply covered with northern drift, composed of alternating layers of blue and yellow clay, sand, and gravel, and containing large quantities of fossils. The water from the drift is pure and good; its chief saline ingredients are chloride of sodium and carbonate of lime. The rivers flowing over the drift are singularly pure, the quantity of dissolved mineral substances rarely exceeding eight or ten grains to a gallon of 70,000 gr. The water from the rock formation underlying the drift is generally very indifferent, frequently containing carburetted hydrogen, sulphuretted hydrogen, and an abundance of mineral substances; among which the most prominent are Na Cl; Na O SO³; Mg Cl; Ca O, CO² + H₂O. The water of wells sunk into the different rock formations is frequently rendered worthless for culinary purposes by large impregnations of sulphuretted hydrogen and salts. In fact, the depth of the drift seems, in a great measure, to determine the purity of the water. As long as the drift seems to be penetrated, the water is palatable and good, and may generally be considered excellent. As soon, however, as the foundation rocks are tapped, its purity is destroyed, or at least much impaired. This is a general rule, but not without exception.

The waters of the Ottawa and some of its tributaries are extremely turbid, and of a reddish hue, deriving their color and organic impurities from the Tamarac Swamps, which fringe their shores for many miles, and which form the source of numerous minor streams. In strange contrast with the Ottawa waters are those of the St. Lawrence, which, while devoid of such mineral impurity, soon disengage themselves of the load of organic matter poured into them by the rapidity of their current, and their perfect aërication during their tumultuous descent towards Montreal. The tertiary drift is found in the valley of the St. Lawrence, reposing upon lower Silurian deposits as far as Quebec. The fossiliferous strata fringe the course of the St. Lawrence, and are bounded by the metamorphic series of the Laurentine Mountains on the northwest, and the Green Mountains on the southeast. The St. Lawrence valley must be considered as a narrow peninsular prolongation of the great American trough, embracing, however, only the lower Silurian groups, superimposed by tertiary clay.

Dr. Archibald Hall, the distinguished Professor of Materia Medica in McGill College, Montreal, declares that calculous affections are rare in that city and neighborhood, especially among the French Canadians. He does not remember to have heard of over a dozen cases during a residence there of twenty years. He never met with an instance of vesical calculus in his own practice, and with only one of renal calculus. The most common form of concretion is the uric acid. The case of renal calculus, just alluded to, was one of ammonio-magnesian phosphate.

Dr. Hall considers the district of Montreal as remarkably exempt from these complaints; and he asks the question, whether this circumstance may not be due to the predominance of the limestone formation as the main geological feature of that region, and the consequent impregnation of the water with that earth, and also magnesia? From an analysis by Mr. Hunt, of the Geological Commission of Montreal, it appears that 100,000 parts of water drawn from a hydrant in that city, in the spring of 1850, yielded 7.550 parts of carbonate of lime and 2.044 of carbonate of magnesia. The proportion of these salts varies much at different points of the St. Lawrence. Thus, according to the same authority, samples drawn at the following localities yielded in 100,000 parts:—

	St. Ann's	Lachine.	City Water-Works.	Canada.
Carbonate of lime	2.480	6.440	7.400	8.033
— magnesia	696	1.970	2.160	2.537

Another remarkable feature in regard to the water of the St. Lawrence, is the amount of solid residue which it contains. This is larger, it would seem, than in almost any other water in the northern rivers of this continent, as is shown by the following comparison:—

St. Lawrence Cascades	10.76
Croton, New York	7.98
Schuylkill, Philadelphia	4.95
Cochituate, Boston	1.46
St. Charles, Quebec	2.45

Taking into consideration the large amount of solid residue in the water of the St. Lawrence, and the fact also that the spring water of Canada is highly charged with lime, in the form of carbonate, sulphate, and chloride, Dr. Hall is inclined to ascribe the immunity from calculous disease among the inhabitants of Montreal and the surrounding country mainly to this quality of the ordinary beverage, whose constitution, he thinks, is unquestionably antagonistic to its development.

During a visit which I made to Quebec, in the summer of 1853, I took particular pains to inquire relative to the present subject, and was told by a number of the most respectable practitioners of that city that calculous diseases are very infrequent, both there and in Canada East generally. Quebec, with its suburbs, contains about 40,000 inhabitants, and limestone water is freely used for drinking and culinary purposes.

Nova Scotia.—Through the kindness of Professor Hall, of Montreal, I have been able to obtain some information respecting the prevalence of calculous diseases in Nova Scotia. My correspondent is Dr. R. S. Black, a distinguished practitioner of Halifax.

The affections in question are so rare at Halifax and throughout Nova Scotia that Dr. Black has not met with a solitary instance during a practice of fifteen years, nor has he heard of any case in the practice of his professional brethren. At a meeting of the Medical Society of Halifax, last September, attended by some of the oldest practitioners of the town and neighborhood, the general opinion seemed to be that this class of diseases was almost unknown in the province, only two cases being cited as having occurred during the last thirty years, and one of these had probably been imported, the patient being a Scotchman from Pictou. The other subject was a boy who was operated upon in the United States.

"To what cause to attribute this remarkable infrequency of the diseases in question," says Dr. Black, "I know not, unless to an abundant supply of pure water, which is brought into the city in iron pipes, a distance of five miles, from Long Lake, which rests upon a granite bottom. The geological formation of the peninsula, upon which the town of Halifax is built, is a hard, slaty rock."

§ 3.—PREVALENCE OF STONE IN THE BLADDER AND CALCULOUS DISORDERS IN FOREIGN COUNTRIES.

England.—Calculous disorders are frequent in England. Dr. Prout¹ calculates that, on an average, 1 in 50,500 dies annually of stone in that country. The greatest mortality appears to be at Manchester, where it is in the proportion of 1 to 13,200. In York, Durham, and Wales, it is 1 in 31,000. In Stafford, Lancashire, West Riding of Yorkshire, Leeds, London, and Liverpool, the mortality exceeds the average; while in Norfolk and Suffolk it is below the average, being about 1 in 64,500. In Cheshire, Dorset, Oxford, Essex, Devon, Cornwall, and Somerset, it is only 1 in 207,000, or upwards of fifteen times less than at Manchester.

Dr. Dobson, in his "Commentary on Fixed Air," published in 1779, states that the proportion of stone cases in the Gloucester, Worcester, Hereford, and

¹ On the Nature and Treatment of Stomach and Renal Diseases, p. 463, fourth edition, Philadelphia, 1843.

Exeter Hospitals was 1 in 394 patients. In the northeastern part of England, embracing the public institutions of New Castle, York, Leeds, and Manchester, it was 1 in 420; while in the northwestern district of the kingdom, including the infirmaries of Liverpool, Chester, Shrewsbury, and the whole of North Wales, it was only 1 in 3,223.¹

It is not known, I believe, what the relative frequency of calculous disease is in London. Dr. Yelloly, about twenty-five years ago, stated it to be as 1 to 38,000. London is seated on the tertiary formation, and is supplied with very impure water.

In Cheltenham, England, calculus is very rare, the inhabitants using very pure and excellent water. In the county of Hereford, with a population of 89,000, no case of stone in the bladder occurred in the public hospital from 1775 to 1820, a period of forty-five years, although upwards of 16,000 patients were treated in it during that time.² Another fact which deserves mention, in connection with this county, is that cider is very generally drunk by the inhabitants; a circumstance which would seem to favor the idea, advanced in the text, that this article exerts, at least by itself, no influence over the origin and development of vesical calculus. In the coal regions of England, especially in the counties of Durham and Northumberland, stone in the bladder is very infrequent. The same remark is true of Cornwall, a granite district, comprising the Land's-end, as it is called, and noted for the purity and excellence of its waters.³

Ireland.—According to the inquiries of Dr. Yelloly,⁴ published in 1830, stone is a rare disease in Ireland. The country has a large central coal district, nearly surrounded by mountain ranges of primary and transition formation, and covered to a considerable extent by peat bogs; the inference, therefore, is that the water used by the inhabitants, in many parts, contains but little calcareous matter. In the counties of Antrim, Armagh, Londonderry, Donegal, Fermanagh, Tyrone, Carlow, Kildare, Kilkenny, Longford, Lowth, Wicklow, Clare, Kerry, Roscommon, Tipperary, and several others, containing, at the period here stated, an aggregate population of upwards of 3,500,000, not a single case of lithotomy had occurred in any of the respective charitable institutions since their establishment, and but very few in private practice. In the counties of Down, Monaghan, Leitrim, Sligo, Limerick, Queen, and Waterford, only nine persons, out of 1,200,000, had been cut for stone during a period of nearly forty years. In the city and county of Cork, embracing upwards of 800,000 inhabitants, thirteen operations had been performed in the last eighteen years. In the Dublin hospitals, about six cases occur in the course of the year. "Making a suitable allowance, therefore," says Dr. Yelloly, "for the counties from which I have been disappointed in not receiving returns, it does not appear that more than eight operations of lithotomy occur annually among the poor of Ireland, the whole population of which was considered, in 1821, to be about 7,000,000. But when we refer five of those cases to the city and county of Dublin, containing together a population of about 350,000, it will be seen how minute the proportion of calculous patients must be in the remaining population of Ireland, when not more than three operations of lithotomy occur annually among the poor of a population of between six and seven millions."

Dr. Thomas Egan, of Dublin, in a paper published in the *London Medical and Physical Journal* for 1806, also speaks of the relative rarity of calculous disorders in Ireland. The elder Mr. Dease, who enjoyed the most extensive reputation as a lithotomist, never operated, it would seem, upon more than sixty persons, and, what is remarkable, only a few of these were from the country.

Scotland.—Has a much greater number of calculous persons than Ireland; but, as might be supposed, the disease does not prevail with equal frequency in all parts of the country. Thus, in the south, southwestern, and northern dis-

¹ Marcet's Essay on Calculous Disorders, p. 29. London, 1817.

² Mr. Smith, Medico-Chirurgical Transactions of London, vol. xi. p. 1. 1821.

³ Dr. John Forbes, Transactions of the Provincial Medical and Surgical Association, vol. II. p. 42. 1824.

⁴ On the Tendency to Calculous Diseases, in Philosophical Transactions of London. 1830, p. 23-4.

tricts, it is exceedingly rare. In Edinburgh, in the ten years between 1820 and 1830, calculous operations occurred in the proportion of 1 in 57,000; at Glasgow, in fifteen years, 1 in 71,000; at Paisley, in ten years, 1 in 21,000; at Aberdeen, 1 in 44,000; and at Dundee, 1 in 41,000.¹ At the latter town, Mr. Crichton alone, has, during the last sixty years, cut two hundred persons for stone, which, however, is a much larger number than has fallen to the lot of any other surgeon in Scotland.²

France.—Stone in the bladder is of frequent occurrence in France, especially in the departments corresponding with the ancient provinces of Lorraine and Barrois. It was, doubtless, this circumstance which, as has been observed by Civiale, induced Stanislaus, King of Poland, to found at Lunéville a hospital for the treatment of poor calculous patients. During a period of ninety years, extending from 1738 to 1828, 1492 persons were operated on at this institution alone. Of this number, 598 were from Lorraine, Barrois, and the Vosges. The majority came from the towns and communes south of the department of la Meurthe. During a period of less than thirty years, beginning soon after the commencement of the present century, nearly 600 cases of stone have occurred in hospital and private practice at Paris. It is to be observed, however, that many of the patients came from the country, to avail themselves of the superior skill of the surgeons of the French metropolis. The disease appears to have been still more frequent in Paris a century and a quarter ago; for we are informed by Morand that in the short space of eight years, extending from 1720 to 1728, 812 patients were cut at the Hôtel-Dieu and La Charité in that city.

Holland.—Calculous affections are still common in Holland, though not so much so as formerly; for at one time they were more frequent there than in any other part of Europe. Rau, the greatest lithotomist of his age and country, is said to have cut upwards of 1500 persons. The extraordinary prevalence of these disorders has usually been ascribed to the deleterious influence of the cold and humid atmosphere of that country, which, while it is unfavorable to the cutaneous perspiration, greatly augments the renal secretion, and thus predisposes to the formation of calculous matter. In Belgium, calculous complaints are sufficiently frequent.

Prussia.—Of the frequency of stone in the bladder in Prussia, we have no definite information. The probability is that it is inconsiderable. Scemmering, Leydig, and Wiedmann, all concur in stating that the disease is remarkably rare in the principal localities where Rhenish wines are manufactured, which are supposed by many to exert a prophylactic influence in regard to this affection. For further remarks on this subject, see page 439.

Spain, Switzerland, and other countries.—The malady is infrequent in Spain, the Sardinian States, and the Ionian Islands. In the latter, which are of a calcareous formation, only 29 cases occurred in a population of 176,800, in a period of ten years, from 1820 to 1830.³ Respecting Switzerland, no reliable information has been published; but in the time of Haller, the affection was rare, and confined chiefly to the children of the poor. At Geneva, in a population, in 1817, of 30,000, lithotomy, including both public and private practice, had been performed only thirteen times during a period of twenty years.⁴ The inhabitants of Saxony, Norway, and Sweden, do not suffer much from calculous disorders; in Denmark, on the contrary, in a population of 2,500,000, the number of cases of stone in the bladder during ten years, was 286. At Copenhagen, it is quite common, 1 person out of 22,000 being affected with it. The Danes consume large quantities of beer, which, in fact, is the national beverage, and the lower classes are noted everywhere for their want of personal cleanliness. The climate is very humid, rainy weather being frequent at all seasons, but particularly in October, November, and December. Copen-

¹ Yelloly, *op. cit.* p. 424-7.

² British and Foreign Medico-Chir. Rev. for July, 1864, p. 160.

³ Civiale, *Sur l'Affection Calculouse*, p. 566.

⁴ Marcet's *Essay on Calculous Disorders*, l. p. 42. London, 1817.

hagen is supplied with water from the neighboring lakes, but very little is drank by the citizens.¹

Austrian Dominions.—The following table constructed by Dr. Von Wattmann, of Vienna,² and founded on official documents supplied by Professor Raimann, affords a view of calculous cases in the Austrian dominions, from 1820 to 1830:—

Provinces.	Whole population.	No. of calculous cases.
Vienna and lower Austria, including the military	1,206,520	49
On the Ems and Salzburg	835,043	18
Galitzia	4,316,086	19
Moravia	2,046,787	39
Bohemia	3,582,150	106
The Tyrol	780,399	11
Styria	854,720	10
Illyria and the Maritime States	1,154,885	31
Venice and the eight Provinces	2,032,339	278
Milan and Lombardy	2,400,000	794
Dalmatia	383,600	49
Total	19,592,529	1,449

The above table gives one case of calculus in 13,531 subjects. It will be perceived that the prevalence of the disorder is much greater in some of the provinces than in others. Thus, in Milan and Lombardy, in a population of less than 2,500,000, there were nearly 800 cases of the disease, or in the proportion of 1 to about 3,226 inhabitants; while Galitzia, with nearly twice the population, furnishes only 19 cases in all.

Vast numbers of cases of stone are operated on at the Austrian capital. Pa-jola performed many of his exploits there; Von Kern, who was Professor of Surgery at the University of Vienna, from 1805 to 1829, lithotomized 334 persons; and nearly 200 operations have been performed since by Dr. Wattmann, chief of the Surgical Clinique of that city.

Stone in the bladder is said to be very common in Hungary.

In the Hospital at Naples, from 1821 to 1830, inclusive, 308 persons were cut for stone in the bladder. Of these 298 were males, and 10 females; 129 were children, 148 adults, and 31 old men; 261 were cured, and 47 died, or in the ratio of about 1 to 5½. The majority were country people, accustomed to hard labor and privation.³

Russia.—Calculous disorders are very frequent in certain districts of Russia; for it appears from the reports of Dr. De Roos,⁴ of St. Petersburg, that 1,411 persons, affected with stone in the bladder, were admitted into St. Mary's Hospital, at Moscow, during a period of twenty-eight years, extending from 1806 to 1836.

Within the brief space of seven years, extending from 1830 to 1836, not fewer than 411 cases of urinary calculus were operated on at the above hospital. In addition to these, 58 others were admitted, but were not considered fit subjects for the knife. It is worthy of note that these cases, amounting altogether to 469, were all, except 77, under 15 years of age. The list embraces none that were under two years, and only three that were over fifty years. It is said that Hildenbrand, Professor of Surgery at Moscow, had lithotomized, prior to 1818, more than 1,500 persons.

Dr. De Roos attributes the great frequency of lithiasis among children in Russia, first, to the use of bad and impure water, containing much earthy matter; secondly, to their want of personal cleanliness; thirdly to the consumption of large quantities of farinaceous food, potatoes, and cakes; and lastly, to the influence of their filthy, smoky, and ill-ventilated habitations.

¹ Dr. Otto's Transactions of the Provincial Med. and Surg. Association, vol. vii. p. 140. 1839.

² Über die Steinzerbörung und ihre verhältnisse zum Harnschneitelte, Wien, 1836; Brit. and For. Med. Rev., vol. iii. p. 254. 1837.

³ Civiale, Traité de l'Affecton Calculense, p. 577. 1838.

⁴ Gazette Médicale de Paris, Dec. 2, 1836; Am. Journ. Med. Sciences, vol. xiv. p. 506. 1839.

Egypt and Turkey.—Stone in the bladder, according to M. Clot-Bey,¹ is quite common in Lower Egypt, while in Upper Egypt it is comparatively rare. During the first few years of his residence in that country, he lithotomized not fewer than forty persons. This was nearly a quarter of a century ago, and I am not aware that he has published anything since contradictory of his former experience. He never observed the disease among the Nubians and Abyssinians. The cause of this disparity is attributable, he thinks, to the humidity of the atmosphere and the unwholesomeness of the water in Lower Egypt, the grounds of which are marshy, and often covered with stagnant, muddy pools, which are used for drinking purposes by the inferior classes, while the better citizens generally employ a purer article, and are, therefore, less obnoxious to affections both of the urinary and other organs. Prosper Alpinus, in his learned treatise on the diseases of the Egyptians, alludes to the frequency of urinary calculi, and ascribes the predisposition to their occurrence to the weakness and irritation of the kidneys, induced by venereal excesses, for which those people are so noted, and to the use of water impregnated with sand and other impurities.

Stone is of frequent occurrence in some of the provinces of Turkey, particularly in Macedonia, Epirus, and Thessaly; and in some families in those regions it is even a hereditary disease.²

India.—Calculous complaints, contrary to the opinion generally received among physicians, appear to be very common in India. Mr. F. H. Brett,³ of Calcutta, who was the first to make this statement, asserts, in support of it, that he cut one hundred and eight persons for stone in the bladder between October 1827 and July 1840, a period of less than fourteen years. On one occasion, he operated, it would seem, on four patients, all from the same vicinity, in one day. The majority of his cases were children under fifteen years of age. Twenty-three were Mussulmans, eighty-three Hindoos, and two Europeans. The late Mr. Burnard cut about forty persons for stone at the city of Benares. Mr. Darby, of Almorah, Mr. Bell, of Hawalbang, Mr. McGregor, of Loodianah, Mackinnon, Finch, McCra, Edgerton, Jackson, and others have also performed the operation a number of times. The most prevalent varieties of calculi in India are the lithic acid and lithate of ammonia. Mr. Burnard is of opinion that one of the most fruitful sources of urinary deposits among the Mussulmans and Hindoos is the habitual use of coarse unleavened bread, and in this view Dr. Brett appears to concur.

¹ Johnson's *Médec-Chir. Rev.* N. S. vol. xxii. p. 486. New York, 1833.

² Dr. F. W. Oppenheim, *über den Zustand der Heilkunde in der Europäischen und Asiatischen Türkei*, p. 121. Hamburg, 1833.

³ *Surgical Diseases of India*, p. 185. Calcutta, 1840.

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